An MDM PUBLICATION
Issue 7 – August 2001

IFP

INTERNATIONAL FIRE PROTECTION

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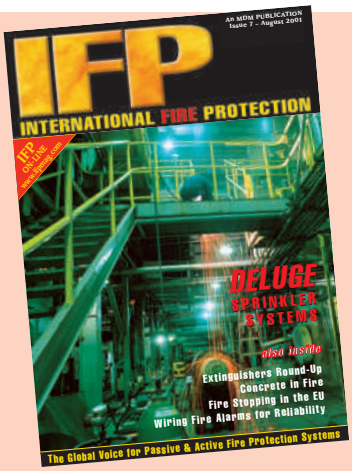

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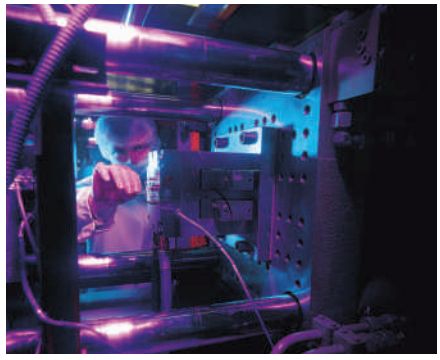

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COMMENT . . .

WE CAN SCARCELY BELIEVE that the August Issue 7 is upon us already. We have put together some of our best editorial for this issue and as always, we hope that you find it informative and interesting.

Issue 7 brings a small technological change to the magazine. Due to feed back from you, the readers and the majority of our regular advertisers, it became apparent that the reader reply card system that we had offered below each advertisement was no longer up to date enough to cope with the rapid turnaround in information supply, we all now expect.

International mailing is not the most effective way of communicating these days, as unfortunately the postal services around the world can't be relied upon to deliver the information to us quickly enough. It appears most of you would prefer the option of using e-mail, websites, telephones and fax machines when enquiring about product information. You will have noticed over the last few years that most advertisements now carry these address details within them, to attract enquiries.

Therefore we have broken with the age-old publishing tradition of enquiry cards and replaced it with the new technology. You will now see printed under each advertisement an e-mail or website address or a telephone or fax number. You may still contact the company through whichever medium you prefer, we are just highlighting one option for you. We hope you will now be able to access the information you need in the quickest and most cost effective manner without depending on the international postal services.

All that remains to be said is that we hope you enjoy reading Issue 7 which includes articles from all of our main editorial contributors and please don't forget to mention IFP when you make your enquiries to our advertisers.

Until next time . . .
Kind regards

David Staddon & Mark Seton
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Is your planned or existing fire alarm system as safe as it could be?

by Neal Porter

Deputy Sales Director, Klaxon Signals Ltd, 502 Honeypot Lane, Stanmore, Middlesex, HA7 1JR, UK

The importance of considered selection and use of sounders and sirens in fire alarm systems, with example applications ranging from commercial premises to wide area warning.

Technical advances in fire detection and control have significantly improved the safety of public buildings and industrial areas over the past few decades. However, the need to provide an effective warning device to communicate an emergency remains a key requirement to initiating fast evacuation.

Noise and sounds constantly bombard us in our daily lives. Mobile phones, reversing and security alarms, kitchen equipment, industrial plants, moving machinery and music all add to the background noise. In order to be effective, a fire or other emergency alarm must be clearly heard and understood if it is to initiate action and save lives.

There is a wider choice of sounders available to an engineer or installer today than at any time, and this presents a significant challenge when attempting to select the most appropriate units for a particular application.

Some sounds have become almost universal in their use as a warning device. Bells, for example, have been used for fire warning for many years, are very effective and need almost no prior explanation to their intended audience. This is also true of sirens, which are always associated with an emergency. Electronic sounders, while having the benefits of a greater choice of tones and the lowest current draws, also present the greatest opportunity for confusion.

Before looking at the use of sounders in different applications it is important to understand how sound levels from a particular device are calculated.

Sound levels quoted by manufacturers are usually at a distance of 1 metre. Each time you double the distance from sounder; you lose 6 dB from this quoted figure. For example, a 100 dB sounder at 1 metre will give 94 dB at 2 metres, 88 dB at 4 metres and so on. **Figure 1** shows the sound levels at different distances for a given output at 1m and can be useful starting point in the selection process. Other factors then need to be allowed for such as internal partitions and doorways, ambient noise and, outdoors, wind direction and speed. It is important with electronic sounders to use the sound output figure for the intended tone rather than the highest figure quoted by the manufacturer. This is because sound outputs vary widely depending on the tone selected and can seriously affect the performance of the alarm.

IS YOUR PLANNED OR EXISTING FIRE ALARM SYSTEM AS SAFE AS IT COULD BE?

Typical fire alarm sounders for commercial use.

m	dB (A)																							
1	65	70	75	80	85	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130
2	59	64	69	74	79	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124
3	55	60	65	70	75	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120
5	51	56	61	66	71	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116
10	45	50	55	60	65	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
20	39	44	49	54	59	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104
30	35	40	45	50	55	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100
50	=	36	41	46	51	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96
100		=	=	40	45	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
200				=	39	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84
300					=	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80
500						=	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76
1000							=	=	=	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
2000									=	=	=	38	40	42	44	46	48	50	52	54	56	58	60	62	64	
3000												=	=	38	40	42	44	46	48	50	52	54	56	58	60	
5000														=	=	38	40	42	44	46	48	50	52	54	56	

Figure 1: How sound varies with distance.

Frequency also plays a part and, in general, lower frequencies travel further and are more effective in almost any environment. Most fire alarm sounders have a frequency between 500 and 1000 Hz.

Positioning also affects the way an alarm will be heard. It is extremely important to position sounders away from immediate obstacles and at appropriate heights. For an indoor application, a height of 2 to 2.5 metres is ideal, while for wide area coverage outdoors, 6 to 8 metres is more appropriate.

A sounder positioned against a wall will give a higher sound output as some sound is reflected, and a combination of wall and ceiling enhances this further. **Figure 2** shows some typical noise levels for a range of different environments. It is always important to verify background noise levels prior to selection of a sounder, particularly in the more unusual locations.

In order to aid selection, it is worth considering the main types of application and the units most suited to them. There are three main categories:

COMMERCIAL: offices, retail premises, restaurants, pubs, clubs and hotels

INDUSTRIAL: manufacturing, warehousing and petrochemical

WIDE AREA: remote or open areas of large sites

For commercial applications the main choice is between bells and electronic sounders. Bells have the advantage of an easily recognized and effective signal while electronic sounders have a wide choice of tones and a current consumption as low as 4mA. Because background noise tends to be at a fairly constant level of around 60 to 70 dB it is usual to use a larger number of small sounders or bells with an output of about 100 dB. This will give a good coverage without creating the high alarm levels that would cause panic and hinder effective evacuation plans. A general rule is to create an alarm tone that is between 5 dB and 15 dB above the background noise. A basic wall mounted sounder is suitable for most applications, however, the use of ceiling mounted sounders

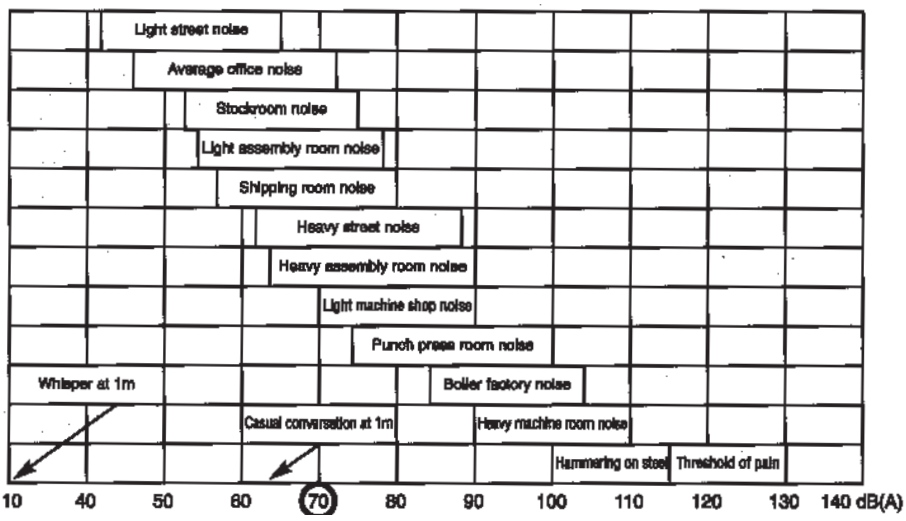

Figure 2: Typical noise levels.

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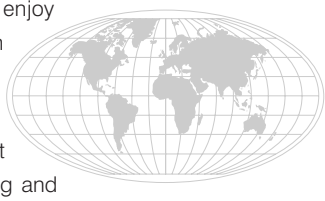

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IS YOUR PLANNED OR EXISTING FIRE ALARM SYSTEM AS SAFE AS IT COULD BE?

combined with fire detectors is increasing as they provide a more aesthetic appearance and may be run from the same circuit, reducing installation costs.

Some countries like France, Holland and Australia have a specified alarm tone that is used for all fire systems and eliminates any confusion about the alarm. Others like the UK do not and while this is satisfactory for an educated audience, for example those in workplaces where alarms are tested on a regular basis, it does present problems in public buildings. One solution to this is to use voice evacuation systems or voice-enhanced sounders where clear communication can be given. Voice evacuation systems are expensive and more suited to larger premises, while voice-enhanced sounders are most suited to small or medium size installations, can transmit both sound and voice messages, and are compatible with most existing alarm systems.

Units with voice alarm options are often important where a fire alarm message needs to be given in different languages, for example in hotels holding overseas guests. They are also of use in pubs and clubs where they can eliminate confusion with music, and generate a fast response from a relaxed audience that may be largely indifferent to an emergency alarm.

High output sounder for noisy environments.

High output siren designed for use in explosive atmospheres.

A new device is now also available which provides directional sound using a combination of white noise and alarm signals which can speed evacuation times by up to 60%. This is particularly effective where smoke is present as the sound can direct occupants with restricted vision to the nearest exit. The tones vary from sounder to sounder and are intuitive allowing decisions like going up or down a stairwell to be made correctly even without prior knowledge of the building layout.

In industrial areas, the background noise can vary enormously from 50 dB to over 120 dB. In general, the use of higher output devices are recommended

Wide area siren.

and other considerations such as weatherproof protection, material of construction, and, for petrochemical plants, any explosion proof requirements may also be important.

The choice of devices is generally between high power electronic sounders or sirens, and needs to take into account other factors including any conflicting alarms on cranes, machinery and forklift trucks.

Electronic sounders provide the greatest choice of tones and have the lowest power requirements while sirens offer the highest sound outputs for a significantly lower cost. In areas of high background noise and/or ear defender areas it is wise to supplement the sounder with some visual warning from a beacon or strobe. Combined sounder/beacon units are available which reduce cost and installation time.

For wide area coverage on larger sites where people may be working on site in the open or in remote buildings it may still be appropriate that they are warned of a fire incident and follow the same evacuation plan as other personnel.

In this situation, high power sirens or electronic sounders need to be used. Sirens with an output of 135 to 145 dB have an effective range of up to 5 km depending on the local conditions. Compared to electronic units their sound is more penetrating due to the better quality of the sound generated, and is usually more audible. Electronic sounders, however, are easier to run from backup batteries.

It is crucial to verify what other warning sounds apply on site and their purpose. On many petrochemical sites for example, a traditional siren is often the toxic gas alarm. The fire alarm would need to be a totally different signal in this case to avoid confusion as the evacuation plan may differ depending on the emergency. Because the environment can affect the performance in these applications it is almost always essential to carry out surveys and site tests before a unit can be selected. Factors affecting selection include the position of power supplies, nature of the terrain, positioning of tall buildings, background noise from working machinery and range of coverage required.

On most occasions, selecting the most appropriate siren or sounder is a straightforward task and a combination of experience and common sense will deliver a good result and ensure the highest level of safety. If there is any doubt, manufacturers can always offer detailed advice on positioning and sound output.

Wide area electronic sounder.

Fire Stopping in the EU

Picture courtesy of Warrington Fire Research Centre.

MANUFACTURERS wanting to sell their products into a wider European market are often faced with a plethora of complicated test and approval routes that would deter all but the stout hearted. This process is complicated yet further for fire stopping and gap sealing products due to the great diversity, (or in some cases the complete absence), of national test standards and approval requirements. All of this is due to change under the requirements of the Construction Products Directive, which aims to enable free trade between member states within the European Union. This article by DAVE WILLIAMS of Warrington Fire Research Centre outlines the basic principles of common European approval system that is now taking shape.

At present companies wanting to sell their fire stopping and gap sealing products in more than one member state will generally have to test in each to prove compliance with the national requirements (BS 476, DIN 4102 and so on). While a test undertaken in one state may have some currency in another, as supporting data, the process is often easier said than done. For many companies the cost implications of widespread testing for approval in a number of states is prohibitive and thus serves to limit their market area.

The new European system is based on the premise that a company need only test the product in one member state, gaining a classification based on the test result, which can then be used to satisfy the requirements of a Product Standard (hEN) or European Technical Approval (ETA). The hEN or the ETA outline the additional requirements for the particular level of Attestation of Conformity required in order to gain a CE mark. This, in principle, creates a level playing field, allowing the product to be sold freely into any Member State. Although the principle sounds straightforward, manufacturers might raise an eyebrow and ask 'will it really be as straightforward as that?' The honest answer is probably 'No'.

The simplest way to look at what is involved is to break it down into two stages, the first stage being to generate the test data the second to satisfy the requirements of Attestation of Conformity.

Testing

The simplest scenario to consider is that of a single test by a manufacturer, but in reality most manufacturers have a large scope that they wish to cover and so will undertake a number of tests. Both prEN 1366-3 (Fire resistance tests for service installations – Part 3: Penetration seals) and prEN 1366-4 (Fire resistance tests for service installations- Part 4 Linear joint seals) detail the test methods for penetration sealing systems and gap sealing systems and both contain a 'direct field of application' which enables simple extrapolation of the original test data to give a wider scope of use. The 'direct field of application' rules are therefore the simplest form of assessment, which is *directly* applied to a tested product based on achieved results. They cannot, however, be used to combine results from more than one test. All tests undertaken to the new European test standards will automatically contain a limited, but useful direct field of application.

The test itself and the direct field of application give results that are presented in accordance with the requirements of the classification document, prEN 13501-2 (Fire classification of construction products and building elements – Part 2: Classification using test data from fire resistance tests). The results will be presented to show each classification period satisfied, for example a fire test giving 120 minutes integrity and 95 minutes insulation performance could be classified as E120, EI90, EI60, EI30. These classifications relate to a given fire resistance period and are applied in each member state in accordance with their building codes and regulations, the latter varying to meet local needs.

Where the results of one test are required to be combined with another to give a greater scope, which will be the case for the majority of tests conducted in the UK, it falls outside the limits of the 'direct field of application'. At present this type of request is handled, more often than not, at the testing laboratory. Experts give an assessment, that is an expert judgement, on what can or cannot be done to extend the scope of use of the product by combining data. The judgement of one expert may well vary from that of another and as such the scope of

Picture courtesy of Warrington Fire Research Centre.

the assessment is based on the knowledge of the assessor.

The scope for expert judgements under the new system is restricted to ensure that assessments are consistent in their scope between member states, and the Commission has mandated CEN through various working groups, to produce Extended Field of Application documents. These give a combination of guidance and rules relating to various modifications from a tested design or system that are allowable and the expected effect, whether positive, negative or neutral in relation to the classification. The assessed results are then reclassified in accordance with prEN 13501-2.

The Construction Products Directive lays out six essential requirements that must be satisfied in order for a product to be placed on the European market. Mainland Europe requires all products to be CE marked, and although this is not a requirement in the UK, manufacturers still have to comply with the essential requirements. Therefore, having fire test data and classification will not normally be enough, especially for those manufacturers wishing to export to mainland Europe, where the CE mark is obligatory.

Attestation of Conformity

Attestation of Conformity is the route by which a manufacturer proves that his product complies with the essential requirement of the CPD. The CE mark can then be applied to the product indicating that a product is fit for it intended use. The CPD specifically states that a product is fit for its intended use if it conforms to the following:

- **A Harmonised European Standard (hEN)**
- **A European Technical Approval (ETA)**
- **A Non-harmonised technical specification recognised at Community level.**

Due to the diversity of fire stopping and fire sealing products, product standards in the form of Harmonised European Standards hEN's will not be produced. Instead the Commission has mandated the European Organisation for Technical Approvals (EOTA) to produce guidelines in the form of ETAG's (European Technical Approval Guidelines), which can be used to gain European Technical Approval (ETA). These documents (the ETAG's) will provide guidance on all the areas that need to be evaluated by test to determine if they satisfy the six essential requirements of the CPD for safety in use, the fire test performance being only one area.

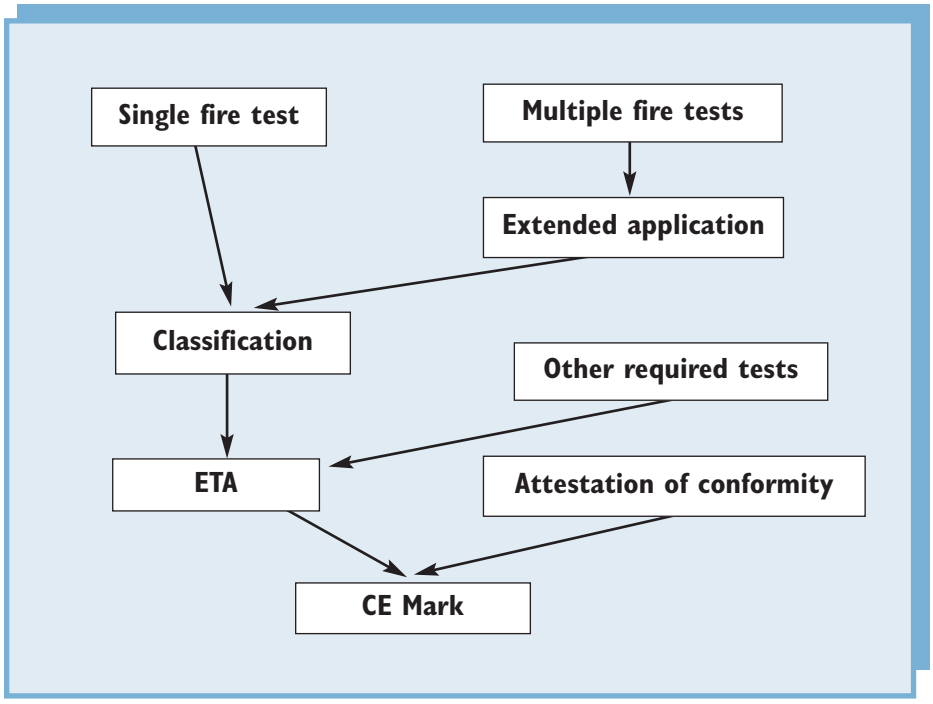
Depending on the intended end use of the product, the other test information required may relate to suitability for load-bearing or movement applications; internal or external environmental exposure; extreme temperature and environmental exposure; UV radiation; chemical resistance; moisture resistance and so on. The list of requirements that may need to be considered is quite extensive, but it should be noted that a manufacturer can declare 'no performance determined', that is, that the product has not been tested to meet that specific requirement.

The potential risk of doing this is that a product, which lists several areas as 'no performance determined' may be seen as inadequate or inferior against those, which have been tested. This may not be the case if the intended end use and declared application are not relevant to a particular aspect of performance. For instance a penetration seal installed around a riser pipe in an enclosed shaft in an air conditioned building may not need an environmental exposure rating for extreme cold, or a load-bearing capacity rating. Conversely the same seal may require a performance of suitability at specified humidity conditions and be shown capable of satisfying an impact criteria test. The ETA enables a product to be assessed for its specific end use application. As such, two similar products may have different performance ratings depending on the specific application or location in which it is intended to be used.

Due to the large scope of possible tests required by the draft ETAG's the current industry view is that they may be more onerous than product standards produced for other product types, although we will have to wait for the final versions to be issued to fully compare these. Discussions continue regarding exactly what areas should be considered within an ETAG and more importantly the use of the 'no performance determined' statement.

Once the ETAG is completed (currently anticipated as late 2002), a manufacturer will have to contact an ETA body, which will prepare the ETA for that particular product.

The system of Attestation of Conformity to apply the CE mark may be high or low depending upon the criticality of the product with respect to fire and



The route to CE marking of fire stopping and fire sealing products

its consistency of production. The highest level of conformity is system 1 and this requires third part product certification. Fire stopping and fire sealing products will be required to have system 1 Attestation of Conformity to apply the CE mark. This means that the product is subject to test by a third party under the supervision of the Certification Body, who will also supervise/check the quality of the factory production control (FPC). The Certification Body must be a Notified Body, that is Notified to the EC by a Member State as able to provide the necessary attestation procedure. A single Notified Body must be appointed to coordinate the entire test and approval requirements for the product across all of the essential criteria, although they may subcontract the tests to others with particular expertise. It is important that the Certification Body works in close liaison with the ETA body to ensure that any tests done to gain the ETA can be used in support of the attestation procedures for CE marking. Once the Certification Body is satisfied that all the essential requirements and the factory production control have been complied with, they will issue the manufacturer with a Certificate of Conformity. The manufacturer is then able to apply the CE mark. With the CE mark in place the manufacturer can freely sell his products across the member states.

Summary

While the process of approval seems onerous and complex, for those required to satisfy Level 1 Attestation of Conformity it actually becomes quite simple. The first stage is to talk to the ETA body and the certification body that you want to handle the work and tell them the scope and intended use of the product. They should be able to advise the correct tests to conduct to gain the greatest scope from the Extended Application documents and then the ETA requirements. Clearly it is advantageous to use one organisation, which is both an ETA body and a Certification Body. WFRC provides such a service.

It should be reiterated that while the procedure for product approval is now established for fire stopping and gap sealing products, some of the documents on which that approval will be based are still in draft formats, and some are much nearer completion than others. Putting everything into place for free trade to begin in these areas is still some way off. However it is not too early to start to understand the process by which approval will be gained and to identify and talk to the Certification Bodies to establish which is best placed to meet your requirements.

Further details on this subject can be obtained by contacting Warrington Certification, Holmesfield Road, Warrington Cheshire, on 01925 646 777 or by contacting the author on +44(0) 1925 655116.

Dave Williams *is a Senior Technical Officer at Warrington Fire Research Centre. He has over 12 years fire testing experience and has served on the British Standards committee relating to fire stopping and fire sealing products and is currently a member of CEN and EOTA working groups for the production of Extended Application documents and ETAG's in these areas.*

Example of CE-Marking:

CE	"CE"-symbol
xxxx	Number of Notified Body
Any Company Any Town, Any Place, Any Country	Name and address of the manufacturer or his representative established in the EEA and of the plant where the product was manufactured
xx xxxx-CPD-xxxx	Two last digits of year of affixing CE Marking Number of EC certificate of conformity (where relevant)
ETA N° XX/XXXX ETAG XXX, Part 3 Cavity Barrier Type B4 EI 60	ETA Number ETAG Reference Relevant performance characteristics and/or designation code

Location of CE-Marking:
For penetration seals and joint seals, the CE-Marking shall be affixed on accompanying commercial documents.

FSSA news

Cylinder Safety Alert

FSSA has received reports of several incidents where charged fire suppression system cylinders accidentally discharged in an uncontrolled manner. These discharges occurred when the cylinders were being removed from service or during handling.

In each case, improper handling of the cylinder by untrained or unqualified personnel caused the accident. In all cases, actuating devices had not been removed from the valves, and anti-recoil devices and protection caps were not installed prior to removing the cylinders from service.

Pressurized or charged fire suppression system cylinders are extremely hazardous. Most are equipped with high flow rate valves that can produce high discharge thrusts out of the valve outlet if not handled properly. This can result in severe personal injury, loss of life and property damage. Unsafe handling needs to be corrected. FSSA recommends following these guidelines:

First, if any work is to be performed on the fire suppression system, a qualified fire suppression system service company, trained on and experienced with the equipment installed, should be called to do the work.

Personnel involved with fire suppression system cylinders must be thoroughly trained in the safe handling of the containers. This includes the proper procedures for installation, removal, handling, shipping and filling; and connection and removal of other critical devices, such as discharge hoses, control heads, discharge heads, initiators and anti-recoil devices.

Make sure to follow the procedures outlined in the operation and maintenance manuals, owners manuals and service manuals provided by the manufacturer of the specific equipment installed.

Most fire suppression system cylinders are furnished with valve outlet anti-recoil devices and, in some cases, cylinder valve protection caps. **Do not** disconnect cylinders from the system piping, move or ship the cylinders, if the anti-recoil devices or protection caps are missing. Obtain these parts from the equipment manufacturer or an authorized distributor. These devices are provided for safety reasons and must be installed at all times, except when the cylinders are connected into the system piping or being filled.

All control heads, pressure operated heads, initiators, discharge heads or other actuation devices must be removed before disconnecting the cylinders from the system piping. Anti-recoil devices and/or protection caps should immediately be installed before moving or shipping the cylinders. Don't get careless. Never assume that a cylinder is empty. Treat all cylinders as if they are fully charged.

Fire suppression system equipment varies by manufacturer. Therefore, it is important to follow the instructions provided in the equipment manufacturers' manuals. Again, qualified personnel should do this.

FSSA Piping Handbook Available

FSSA's Technical Committee has published the group's *Pipe Design Handbook for Use with Special Hazards Fire Suppression Systems*. The handbook features new design guidelines for use with all types of engineered special hazards systems where the Power Piping Code is specified.

"This is the most comprehensive piping handbook in the industry for use with special hazards fire suppression systems," says FSSA Technical Director Charles Willms, P.E. "It provides guidance for conditions not specified in NFPA standards."

The handbook is currently available in electronic form only. To order and download a copy, visit FSSA's web site at www.fssa.net.

Clean Agent Training Videos Available

FSSA is now selling a four-tape video training series on clean agent suppression systems. The tapes, produced by Protection Knowledge Concepts, Inc., are designed for anyone who designs, specifies, inspects, buys, approves or maintains clean agent systems.

> *"This is the most comprehensive piping handbook in the industry for use with special hazards fire suppression systems"*

Unit one covers the basics of special hazards fire suppression. It includes information on generally building versus special hazards fire protection and answers some basic questions about clean agent systems. What are they? Why are they used? Where are they used?

The second tape addresses standards and regulations. It covers Halon issue, NFPA standards for clean agents, the EPA SNAP list, NOAEL and LOAEL and alternative clean agents.

The third tape covers alternative agents to Halon 1301. It addresses carbon dioxide, INERGEN, FM-200 and FE-13 systems.

The fourth tape covers maintenance and training issues. It addresses fire detection and alarm systems, basic maintenance of clean agent systems and personnel training.

This series is a must for anyone involved with clean agent systems. The cost for FSSA members is $299 per set. For non-members, the cost is $399 per set. To order your set of training videos, visit the FSSA web site at www.fssa.net or contact FSSA headquarters at 410-931-8100.

Technical Training Seminar

FSSA's 2001 Technical Training Seminar will be held September 14-15 at the St. Louis Airport Hilton in St. Louis, Mo. This intense, two-day training program provides attendees with valuable technical and industry information. Topics covered at this year's meeting will include carbon dioxide suppression systems, NFPA Standards 2001 and 72, inspection reports, licensing, clean agent suppression systems, the Voluntary Code of Practice for reducing Halon emissions, safe handling of cylinders, NICET and customer relations. Registration information is available online at www.fssa.net.

Marco Island to Host 2002 Annual Meeting

FSSA's 2002 Annual Meeting will be held February 6-10 at the Hilton Marco Island Resort in Marco Island, Fla. The meeting is themed, "Celebrating Our Past. Shaping Our Future." FSSA will be celebrating its 20th anniversary in Marco Island and shaping its future with top quality marketing and management strategies, updates on codes and standards and unparalleled networking opportunities.

For more details about the meeting agenda and registration information, visit FSSA's web site at www.fssa.net.

A leading company in fire-extinguishing systems

DuPont FE-13™ new generation of clean agents replacing halon 1301

LPG
TÉCNICAS EN EXTINCIÓN DE INCENDIOS, S.A.

DU PONT®
FE-13™ is a DuPont trademark

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MARKET GUIDE TO

Clean Agents (Halon Alternatives) are gases that extinguish fires in one of two ways. Halocarbon agents absorb heat from the fire to the point where combustion can no longer occur. Inert gas agents, lower the hazard's oxygen content below the level necessary for combustion. The agents are "clean" because they extinguish a fire in seconds and leave no residue to damage sensitive or irreplaceable objects.

Clean agent systems work on class A, B and C fires. Because they extinguish fire as a gas, they permeate into cabinets and obstructed areas. That makes them uniquely suited to protect the electronics hidden inside a piece of equipment – a likely place for a fire to start.

Here ***IFP*** gives you what is probably one of the most extensive sources of Clean Agent information you'll find. No doubt most of you are familiar with the company and brand names here. We have tried to ask as many pertinent questions as possible to give you the best overall information about each product featured without getting overly technical.

	AMERICAN PACIFIC	DU PONT FIRE EXTINGUISHANTS
Halon Alternative	HALOTRON	FE-13™
Manufacturer	American Pacific Corporation	DU PONT
Chemical Family	HCFC	HFC
Chemical Formula	$C_2HC_12F_3$ (HCFC-123) + Proprietary Gax Mixture	CHF_3
Molecular Weight	150.7	70
Boiling Point @ 1 ATM	80.6°F	–82.0°C
Critical Temperature	354.15°F	25.9°C
Heat of Vapourization @ Boiling Point	N/A	103.02
Acute Toxicity (Cariotox LOAEL)	2%	>50.0%
Acute Toxicity (Cariotox NOAEL)	1%	30.0%
Ozone Depletion Potential (ODP)	0.014	0
Global Warming Potential (GWP)	90, based on HCFC-123	11700
Atmospheric Lifetime	3.5–11 Years	264 Years

	3M	GREAT LAKES CHEMICAL CORPORATION
Halon Alternative	Novec 1230	FM-200
Manufacturer	3M	Great Lakes Chemical Corporation
Chemical Family	Fluorinated ketones	HFC
Chemical Formula	$CF_3CF_2C(0)CF(CF_3)_2$	CF_3CHFCF_3
Molecular Weight	316.04	170.03
Boiling Point @ 1 ATM	48°C	2.55 (F)
Critical Temperature	TBD	215 (F)
Heat of Vapourization @ Boiling Point	23.0 cal/g = 96.4 kJ/kg = 41.4 Btu/lb	57.0 Btu/lb
Acute Toxicity (Cariotox LOAEL)	>10% v/v	>10.5%
Acute Toxicity (Cariotox NOAEL)	10% v/v	9.00%
Ozone Depletion Potential (ODP)	0	0
Global Warming Potential (GWP)	1	2900 (100-yr)
Atmospheric Lifetime	5 days	36.5 yr

HALON ALTERNATIVES

DU PONT FIRE EXTINGUISHANTS	DU PONT FIRE EXTINGUISHANTS	DU PONT FIRE EXTINGUISHANTS
FE-25™	FE-36™	FE-227™
DU PONT	DU PONT	DU PONT
HFC	HFC	HFC
CF_3CHF_2	$CF_3CH_2CF_3$	CF_3CHFCF_3
120	152	170
–48.3°C	–1.4°C	–15.6°C
151.3°C	124.9°C	101.7°C
70.7	68.8	56.7
10.0%	15.0%	10.5%
7.5%	10.0%	9.0%
0	0	0
2800	6300	2900
33 Years	209 Years	36.5 Years

NEWHOUSE INTERNATIONAL	SAFETY HI-TECH	TSS ANSUL
Triodide	NAF S 125	Inergen
Ajay North America	Safety Hi-Tech S.r.l.	Ansul Incorporated
Trifluoromethyliodide	HFC	Inert Gas
CF_3I	CF_3CHF_2 (>99.6% by weight)	52% nitrogen 40% argon 8% CO_2
195.91	164.7	34
–22.5°C	120.02	N/A
122°C	66°C	N/A
5.26kcal/mol	–48.5	N/A
0.4	10%	62%
0.2	7.50%	52%
0	0.00%	0
<1	3,800 Years	0
~1 day	32.6 Years	0

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USA
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American Pacific Corporation
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Great Lakes Chemical Corporation
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Web: www.fm-200.com

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TSS Ansul
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Marinette
WI 54143 – 2542
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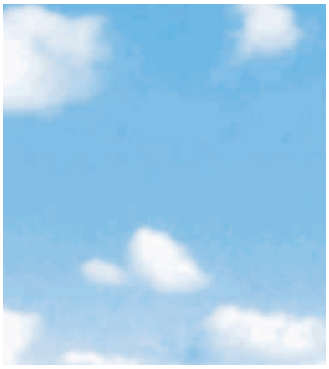
Tel: +1 715 735 7411
Fax: +1 715 732 3477
Web: www.ansul.com

Argonfire® System



Product of Nature.

Vesta Argonfire® System uses a pure natural product, to extinguish fires, which is also electrically non conductive.
Argon is present in the air which we breathe and returns to the natural atmospheric cycle after use.

"Door Fan Integrity Test".

Vesta Argonfire® System extinguishes fire using a total flooding technique, its success, like similar products is dependent on maintaning room integrity. The Door Fan Room Integrity Test confirms the suitability of the enclosure to be protected and **Argonfire®** can easily maintain the extinguishing concentration for 10 minutes as per ISO 14520-1 International Standard.

The Sound of Silence®.

Silence® is the registered trade mark for the new **Vesta Argonfire® System** discharge nozzle. Totally unique, the noise level on discharge is reduced to between 110dB and 60dB equal to that of human speech.

Disturbance.

In addition to lowering the noise level, the new **Silence®** nozzle also reduces the discharge velocity and minimises air turbulence, causing less disturbance of loose documents and articles stored in the protected space.

Approvals.

The hardware (valves, actuators) used in the **Argonfire® System** are already approved by VdS.
January 2003 will see the introduction of new approval requirements for systems to be used within the EU, Vesta is already undertaking the necessary approvals programme which will allow full compliance to these requirements.

CISQ IQNet
Vesta is ISO 9001 certified

VdS ***Certificate of Approval of Components***

IDEA PROGETTO IMMAGINE - MILAN, ITALY

The option you must choose is

tyco Flow Control

DISTRIBUTOR FOR NORWAY - GREECE TURKEY AND EASTERN EUROPE

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7500 AD Enschede The Netherlands
Tel. +31.53.4284444 - Fax. +31.53.4283377

DISTRIBUTOR FOR REPUBLIC OF SOUTH AFRICA

Atlas Control System (PTY) Ltd.
39 Stella Road - Montague Gardens
Cape Town - South Africa
P.O. Box 36634 Chempet Cape Town South Africa
Tel. +27.0.215515080 - Fax +27.0.5525773

is a must not an option.

Continuing Protection.

After discharge, a speedy refilling procedure is necessary to provide continuing protection.
A unique "on site" refilling system has been developed by Vesta, providing a fast, safe and efficient method of refilling discharged systems, returning them to the original condition.

Project Safety.

The software used as the basis of the system design calculations has been developed by VdS. Extensive testing was undertaken at the Vesta laboratories to validate the data, thus Vesta is able to confidently provide a design based on optimum values.

Guarantees made and kept.

Extensive practical system testing has confirmed the theoretical design data.
Vesta system designs provide to the user confidence and a guarantee, for when they have to be used in a "real" fire scenario.

Human Health.

Personnel safety is a prerequisite during and after discharge, **Vesta Argonfire® System** has undergone exhaustive testing and studies, by leading independent medical bodies. A detailed report is available on request.

Vesta srl in now developing the Argonfire System at 300 bar

Vesta Argonfire.®

Vesta®
DIFENDE DAL FUOCO
PROTEGGE IL VALORE

ARGONFIRE
THE NATURAL EXTINGUISHING AGENT

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E-mail: isabella.marchesi@vestafire.it

UNIQUE 'ONE SIZE FITS ALL' CONVENIENCE FROM PROMAT'S LATEST GENERATION OF FIRE COLLARS FOR PLASTIC PIPES:

PROMASEAL® UNICOLLAR®

A potential cause of fire spreading rapidly through a building is inadequate sealing of services passing through walls and floors. For example in the event of fire, plastic pipes quickly melt to form an opening for the fire to penetrate into the next room. The problem of melting plastic pipes is often solved by securing a fire-rated pipe collar around the pipe where it enters the wall or floor. As the pipe melts, the pipe collars internal lining of intumescent material expands to seal the gap.

Until now, an individual pipe collar has had to be manufactured for each size of pipe, which has meant that the contractor has needed to take some care in ordering the correct numbers and sizes of pipe collars required in the building.

PROMASEAL® UniCollar® is a new, unique method of protecting plastic, due to its 'one size fits all' patented concept of continuous strip technology. The only sizing required is the length of strip to suit the diameters and numbers of pipes which are to be protected, thus ensuring convenience to carry stock and overcoming last minute stock and supply problems for contractors. Wastage due to unused collars is also eliminated. Its installation is quick, easy and ensures an effective fire stop barrier for plastic pipe penetration.

Background Information

Promat Fire Protection Ltd manufactures products, which are used for passive fire protection systems designed to reduce the danger of fire to persons in or about a building structure, by containing the fire or reducing its progress.

All Promat products are manufactured in accordance with accredited BS EN ISO 9002 quality management systems and are tested or assessed by independent bodies including the Warrington Fire Research Centre, the Loss Prevention Council, TRADA and the Fire Research Station in accordance with BS 476.

PROMASEAL® UniCollar® is supplied in a strip which is cut to the required length (the packaging includes a measuring tape to identify the cut-off length), and then attached to the element using ready-made clips which fit into the pre-punched slots on the strip. The system uses Grafitex intumescent technology to effectively block off openings formed when plastic burns in a fire, to leave a solid barrier. This intumescent activating layer is already attached to the metal band and requires no additional fixing.

Extensively tested in several countries to meet both local and ISO testing regimes, PROMASEAL® UniCollar® provides up to 4 hours' fire resistance in floors and 2 hours' in walls on a variety of plastic types, including uPVC, HDPE and P/P. In addition, installation problems caused by the variation in the outer diameter of different pipe types have been eliminated by the continuous strip form.

For further information on this or any of the PROMASEAL® range of fire collars, contact Promat's Technical Department on Tel: +44 (0)1763 264668, e-mail: promat@promat.co.uk or visit the Promat website at www.promat.co.uk.

CF_3I

The Environmentally Friendly Halon

- **Enviromentally clean**
- **Atmospheric life time of less than a day**
- **Zero Ozone depletion (ODP)**
- **Volumetric replacement for Halons 1211 and 1301**
- **Ideal for applications where space and weight are critical**

The Second Generation Halon Replacement

CF_3I is Ajay North America's environmentally friendly safe answer to halon replacement. Unlike CF_3I environmental properties: ODP, GWP, and Atmospheric lifetime, are far superior to those of other halon alternatives.

Environmental Properties of Halon Replacements

AGENT	ODP[1]	GWP[2]	Atm. Lifetime
Halon 1301	12-16	5800	100 years
Halon 1211	4	N/A	15 years
CF_3I	0.04	<5	1 day
Halotron™	0.014	90	3.5-11 years
CEA 614™	0.0	5200	3100 years
FE 241™	0.022	440	7 years
NAF PIII™[3]	0.0172	300	3.3 years
FM200™	0.0	2050	31 years
CEA 410™	0.0	5500	2600
FE 13™	0.0	9000	280 years
CO_3	0.0	1	120 years

1. Relative to CFC-11
2. Based on a 100 year horizon, relative to CO_2
3. Average values calculated based on blend components
4. Detailed calculations indicate that the ODP of CF_3I is most probably below 0.0001

In addition, low extinguishing concentrations make it the only true volumetric replacements for Halons 1211 and 1301 in portable and normally unoccupied system applications.

CF_3I Benefits

ADVANTAGE	CF_3I	HALON 1211/1301
Residue free	YES	YES
Fire fighting safety Good visibility during discharge and long discharge time	YES	YES
Minimize cold shock	YES	YES
Penetrate obstructed areas	YES	YES
Non-corrosive Most metals and plastics	YES	YES
Environmentally safe	YES	NO

Fire Fighting Effectiveness (% v/v)

FUEL	CF_3I	HALON 1211	HALON 1301
Ethanol	3.0	4.5	3.0
Heptane	3.1	3.9	3.0
Methane	2.0	3.9	2.3
Propane	3.0	4.4	2.8
Gasoline	3.6	3.8	3.5

* NMERI Cup Burner Values (+/-10%)
** NFPA 128 Cup Burner Value (+/-10%)

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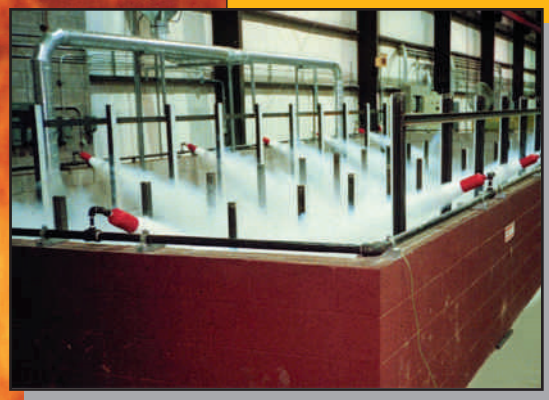
Telephone: +44 (0)1270 780 559 Fax: +44 1270 781 202 Email: Monconsult@compuserve.com

Your Single Source For
Fire Protection



Engineered Suppression Systems

INERGEN®, Foam, CO_2 & Dry Chemical

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tyco

Tyco Suppression Systems

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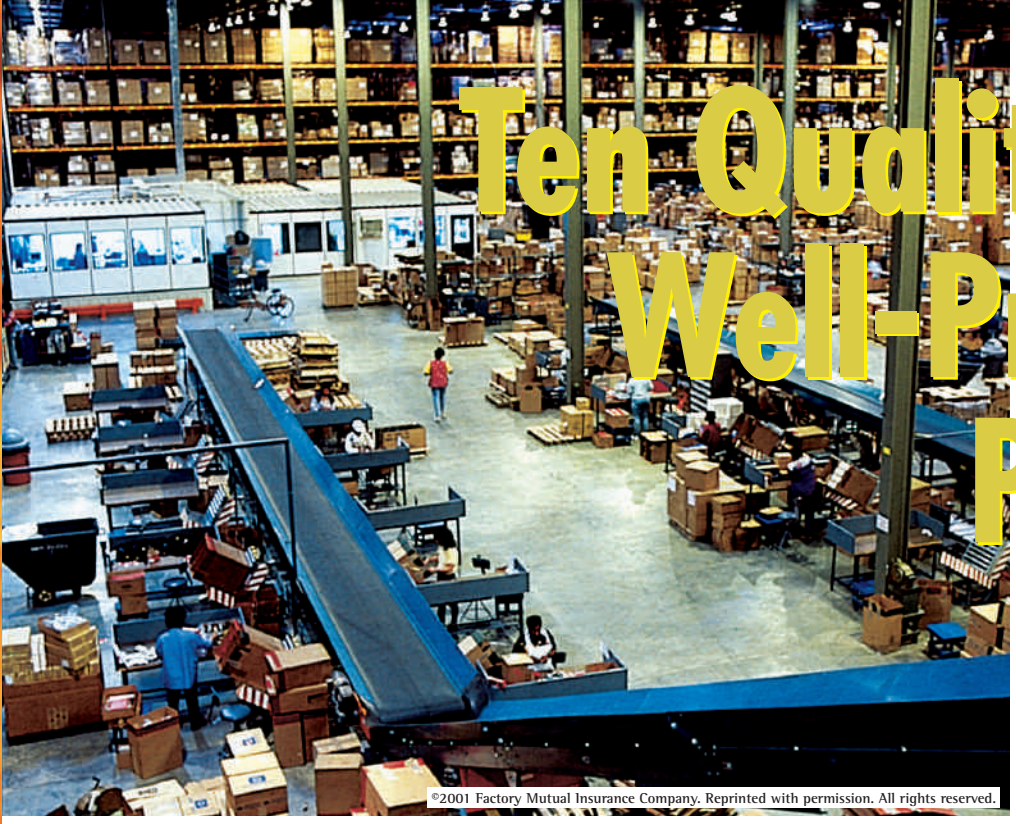

Ten Qualities of a Well-Protected Property

BY FACTORY MUTUAL INSURANCE COMPANY

In today's highly competitive environment, no company can afford the loss of, and productivity from, destruction caused by fire or natural property hazards.

Although insurance can help alleviate some resulting costs associated with property damage, intangibles such as loss of time, customers, goodwill and trained employees, generally are not covered.

The following list contains 10 basic qualities to protect industrial, commercial and institutional properties against fire and can also be applied to other hazards. How well does your facility stack up?

1. COMMITMENT TO LOSS PREVENTION

From the outset, management must commit to loss prevention and see that a loss prevention program is implemented. Concerned management should demonstrate its support by putting the objectives, procedures, responsibilities and accountabilities of such a program into writing. A formal policy statement conveys the company's commitment to loss prevention and encourages employee involvement and enforcement of loss prevention measures.

Employees should be able to react effectively to emergencies and any hazardous conditions they may encounter. Motivated employees are the key to building a continually improving program. They should know that loss prevention and control will be a permanent aspect of their jobs and understand that the actions they take benefit everyone: preventive measures protect their company and their jobs.

2. SUITABLE CONSTRUCTION

A building's construction plays a major role in determining the extent of fire exposure it can withstand and the proposed occupancy of a building is an important factor in determining building design and choosing construction materials. Fire-resistant materials, such as reinforced concrete or protected steel frame, are desirable when a building contains highly hazardous storage or is several stories high. Reduce the possibility of loss by subdividing large areas of your building with firewalls.

Store flammable liquids, combustible dusts and other materials in detached buildings, if possible. If these items must be kept in main buildings, enclose them with a combination of pressure-resistant and pressure-relieving construction. The proper design of damage-limiting construction can vent the force of an explosion in the least destructive direction.

Take note of nearby facilities that may house highly combustible occupancies and design your structure to resist this exposure.

Try to use insulation materials that do not introduce fire hazards. If you must use combustible insulation, protect it with non-combustible barriers and automatic sprinklers.

When planning construction, give preference to a site that has an ample and reliable public water supply and is near a good public fire service.

3. PROTECTION AGAINST EXPOSURE HAZARDS

A complete loss prevention and control program also should take into consideration hazards posed by conditions outside the facility. Exposure hazards created by nearby buildings or outside storage can be devastating. Protect your building by providing adequate distance between buildings.

With fire hazards, the degree of exposure may call for exterior fire

Employees should be able to react effectively to emergencies and any hazardous conditions they may encounter. Motivated employees are the key to building a continually improving program.

doors, wired glass windows with or without outside sprinklers, or the elimination of openings by bricking them up. In general, locate combustibles stored outside at an adequate distance from main buildings.

A well-trained emergency response team (ERT), often aided by other employees, is key in dealing with hazards that originate outside of the facility. The ERT can inspect and expedite repairs to damaged fire protection systems, provide temporary fire protection as needed, restore process and power equipment, salvage storage of raw stock and finished product, make temporary building repairs as needed and, in general, expedite a return to normal operations. A property damaged by one peril is usually more vulnerable to fire than one free from incident.

4. SPRINKLERS WHERE NEEDED

Automatic sprinklers are needed wherever you have combustible construction and combustible occupancy. Sprinklers offer the best automatic, always-on-duty fire control system on the market today. They can mean the difference between a minor business

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interruption and a prolonged or permanent shutdown. In addition, sprinklers can initiate and transmit an alarm and a properly designed system eliminates excessive water damage. A sprinkler system attacks fire where it starts, with sprinklers operating directly over the fire area. If this is not sufficient to control the blaze, neighbouring sprinklers will then activate as needed. Hence, water damage is minimised.

In today's facilities, there are relatively few locations where sprinklers are not needed. Sprinkler protection should be strongly considered for all areas where fire can either start, spread or otherwise cause damage.

5. ADEQUATE WATER SUPPLY

The water supply to sprinklers must be adequate both in volume and pressure. Possible sources include public water mains, a gravity tank, fire pump and suction tank, a natural body of water, or a suitable combination. Pumper connections will help the public fire service reinforce the system further. Keep in mind that a change in occupancy, construction of new buildings or extensions, as well as the introduction of more hazardous processes or storages in existing buildings may increase your water supply requirements. Also take note of any new neighbouring facilities. Their demand of water may diminish the supply available to you.

6. SPECIAL HAZARDS PROTECTED

Many industrial operations involve special hazards that call for additional safeguards.

Handled carelessly, flammable liquids are one of the most insidious threats to industry. At room temperatures, many give off vapours, forming an easily

There is life after Halon

DuPont Fluorocarbon Fire Extinguishants

DuPont has been the leading manufacturer of fire protection products for more than 35 years.

Today, DuPont remains a guiding force in the development of safe, clean Halon alternatives, designed to meet the most demanding applications in the fire protection industry.

The FE family of DuPont Fire Extinguishants, coupled with fire suppression equipment from leading manufacturers, offers the total solution for fire suppression, explosion suppression and inerting applications.

Clean, safe, total fire protection from DuPont

DuPont Fire Extinguishants are high performance total flooding and streaming agents designed to replace the fire protection industry's former product of choice – Halon.

In response to the phaseout of Halon 1301 and Halon 1211, DuPont developed its family of Fire Extinguishants – FE-13™, FE-25™, FE-36™ and FE-241™. They offer the highest possible fire suppression performance in combination with environmental compliance.

Together, they meet the fire threat in every application.

The FE family

FE-13™ – The total flooding agent that replaces Halon 1301 in occupied areas.	**FE-25™** – The Halon 1301 alternative for total flooding of unoccupied equipment spaces.
FE-36™ – The portable, zero-ozone-depletion replacement for Halon 1211 in portable fire extinguishers.	**FE-241™** – A total flooding agent in unoccupied areas.

For more information, please contact:
DuPont de Nemours International S.A. – Du Pont Fire Extinguishants
1218 Le Grand-Saconnex – Geneva, Switzerland
Tel: +41 22 717 5111 – Fax: +41 22 717 6169
www.dupont.com/fire

DUPONT®

DuPont Fire Extinguishants

Enquiries: www.dupont.com/fire

ignited flammable vapor-air mixture. Combustion is extremely rapid, and far greater heat is released than with fires involving ordinary combustibles.

Isolate flammable liquids by distance or construction. Confine flammable liquids with curbs or dikes to avoid contact with any ignition sources. Use appropriate passive physical controls, such as safety cans, grounding straps, safety bungs or interlocks. Provide adequate natural or forced mechanical ventilation in confined areas involving flammable liquids to eliminate concentrations of flammable vapours. Provide employees with procedural training on flammable liquid hazards, and instill safe handling awareness with strict reinforcement of procedures.

Eliminate ignition sources, such as open flames, smoking, static, electrical sparks and hot surfaces. A well-designed automatic sprinkler system will extinguish many flammable liquid fires. You also can use other extinguishing systems, including water spray, carbon dioxide, dry chemical and regular or high-expansion foam, in conjunction with sprinklers.

Dust-producing processes require many of the same safeguards used for flammable liquids.

Flammable gases also require special attention. Again, isolate these storages and confine them to properly designed process and storage equipment to prevent leakage.

Also consider your emergency shutoff valves. The type of valve required and the number and location of each depend on which flammable gas you are storing, the quantity being used, the type of storage tank and the number of storage tanks in the area. Ensure that emergency shutoff valves are easily accessible so you can isolate and stop the flow of flammable gas under adverse conditions such as fire.

7. GOOD HOUSEKEEPING

Good housekeeping is more than just looking neat. Besides frequent cleaning, some basic steps include prompt waste disposal and proper material handling practices – especially in large storage areas. Avoid the build-up of combustible wastes and deposits – such as dusts – from floors, ceilings, structural members, machinery and equipment. An effective

program also includes a formal system for employees to report potential problems. Good housekeeping sets the tone for all loss prevention and control efforts.

8. ONGOING FIRE PREVENTION PROGRAMS

Establish regular, recorded inspections of fire protection equipment. It's essential to physically try locked or sealed valves periodically. Locked valves should be physically tried at least monthly and visually checked weekly. Valve inspection schedules should include all valves and allow ample time for the careful examination of each. List and number every valve in the order in which you examine it.

Inspections also should include housekeeping, flammable liquid handling and control of smoking. Assure that basic flammable liquid safeguards, such as ventilation, diking and containment, are in place. Ensure that smoking materials are confined and contained. (It's up to management to communicate the organisation's smoking policy to all employees.) Also make certain your facility is protected against arson fires. Key safeguards include the provision of security measures and identification of vulnerabilities.

During inspections, you'll want to also check the condition of extinguishers, fire hoses, hydrants, sprinkler alarms, fire pumps, water supply tanks and fire doors.

Occasionally, sprinkler system control valves must be closed for repairs or maintenance. Do this cautiously! This type of impairment leaves your property in jeopardy of fire since its principal means of protection is out of service.

Hot work operations impose fire hazards from sparks that fly long distances and stay hot long after they slip out of sight into holes or cracks. Use a hot work permit for controlling these operations. With the permit, a firesafety supervisor authorises hot work only under specific firesafe conditions. Such a permit has proved to be invaluable.

Ensure that employees and outside contractors use proper hot work procedures and observe appropriate precautions. Continuously monitor areas for up to four hours following hot work. Also, be sure employees take responsibility for requiring outside contractors to conform to your policies.

9. MAINTENANCE OF BUILDINGS AND EQUIPMENT

Inspecting fire protection equipment is not enough. A regular preventive maintenance program for buildings and equipment can prevent breakdowns and save thousands of dollars in replacement costs and business interruption.

Check electrical connections for tightness and inspecting electrical equipment for signs of overheating. Be sure that electrical systems are properly maintained and protected, that they are appropriate to your occupancy and that their intended manner of use is provided. The electrical and physical operating

environment should keep equipment clean, cool and dry. Employees should be trained to operate electrical equipment properly.

You can avoid machinery breakdowns caused by excessive friction by lubricating equipment periodically. Maintenance practices also should include replacement of worn parts, checks on alignment and vibration, and slippage and wear of belts.

In the case of boilers, maintain safety controls and look for any indications of fuel leakage, overheating or overpressure and inspect shutoff valves in process furnaces to ensure proper operation.

10. EMERGENCY RESPONSE TEAM AND PUBLIC FIRE SERVICE

An effective, trained ERT made up of those most familiar with your facility and its operations, can respond quickly to an emergency and help your company recover with a minimum of damage and disruption.

An ERT includes eight key functions for which facility employees should be trained. They are as follows:

- person in charge
- notifier
- sprinkler control valve operator
- fire pump operator
- fire squad
- pipe fitter
- electrician
- salvage squad

Employees that are not directly involved in the ERT still play a role in loss prevention and control. Train key personnel in all departments to use portable fire extinguishers. Give special attention to equipment, processes and materials that have unusual fire or explosion hazards. Emphasise proper operating procedures and maintenance.

Prefire planning with the public fire service enables firefighters to work together more effectively with your organisation. A company representative should make a complete facility inspection with a local fire service member looking at buildings involved, number of stories in each, construction and any special structures, equipment in the building and sprinkler protection.

Once you've compiled a prefire plan, you and the fire service should retain copies. It's important the fire service visit your facility at least annually to keep abreast of any changes that may have occurred.

LOSS PREVENTION AND CONTROL: A CONTINUUM

Preventing and controlling losses is not a new idea. Remember these 10 qualities of a well-protected property, and incorporate them into your daily work functions. If you do not already have a loss prevention and control program at your company, work with a loss prevention consultant to implement these 10 qualities at your facility.

A loss prevention and control program can help protect your company's competitiveness, lower business costs, and improve efficiency and effectiveness. It also could mean the difference between being in business today and facing a permanent shutdown tomorrow.

FM Global offers a variety of publications and training seminars that provide more in-depth information on these 10 qualities and other loss prevention topics. For a complete listing, consult FM Global's online property loss prevention resource catalogue at www.fmglobal.com/store

THE VERTICAL IN-LINE FIRE PUMP

ARMSTRONG INNOVATION

IN 1969, ARMSTRONG presented its vertical in-line pump to the world. This revolutionary pump design was introduced to the fire protection industry in 1993, and since has become the pump of choice of many designers. The vertical in-line pump design provides installation and operation cost savings as well as increased reliability.

The vertical design eliminates the need for large vibration bases and field re-alignment of pumps and drivers. As indicated by NFPA20 section 3-4 and appendices A-3-4.3, fire pumps should be grouted and anchor bolted to substantial reinforced concrete foundation. Due to the large base, this can be an expensive proposition for horizontal pumps. Vertical pumps require a much smaller base which does not join the pump and motor, or can be pipe mounted where approved by the Authority Having Jurisdiction (no base required). Eliminating the common base for pump and motor does away with problems with alignment. In a vertical in-line pump, the vertical rotating assembly is self-aligning, a feature not attainable in direct coupled horizontal pumps with overhung or between-the-bearing impeller designs. This eliminates the time to realign the pump after foundation setting and the recommended check after 10 hours or 3 months of operation.

The most frequent maintenance items in a pump are seals and pump and driver bearings. Horizontal split case pumps have two bearings and two seals which require maintenance over the life of the pump. Direct coupled end suction pumps have two bearings supporting the overhung impeller and a single seal. Vertical in-line pumps have a single seal and no bearings making them the most reliable and easy to service in the long term.

For smaller pump and motor units, the close-coupled design is incorporated (impeller mounted on the motor shaft). For larger pumps and motors, Armstrong employs a revolutionary split coupling allowing seal service or replacement without disturbing the pump or motor. This cannot be done on a horizontal pump without installing a spacer coupling (further increasing the size of the pump and motor unit).

Illustrative of the installation cost savings with the vertical in-line pump is the *firePAK* factory packaged fire pump system. The *firePAK* system incorporates indicating suction and discharge isolation valves, check valve, test tee, minimum fittings, increasers and reducers, fire pump controller, jockey pump, jockey controller, and sensing lines pre-piped and wired on a common base. The *firePAK* system is designed to fit through a 30″ opening making it ideal for new construction or retrofit applications. Factory packaging guarantees compliance of the system with NFPA20 without adding unnecessary costs to a project. True in-line construction makes design of the mechanical room simple and tidy.

Horizontal split case pumps are the most frequently specified and installed NFPA20 compliant fire pumps in the world. This is primarily due to a preference for double suction impeller design at high flows. Recognizing this benefit, all Armstrong Fire Pumps for 750 usgpm and higher flows incorporate the double suction design.

Armstrong offers the world's largest range of approved vertical in-line pumps and packaged systems. Armstrong also manufactures a wide range of end suction and horizontal split-case pumps for 50 Hz and 60 Hz applications and for use with FM approved diesel engine drives. A wide range of pumps of varying designs are available including vertical in-line pumps for flows up to 1000 usgpm and pressures up to 140 psi; end suction pumps for flows up to 750 usgpm and pressures up to 220psi; and horizontal split-case pumps for flows up to 2500 usgpm and pressures up to 280 psi.

Armstrong is committed to continuous improvement of ourselves and of fire protection practice. As such, Armstrong endorses and participates in the National Fire Protection Association, Underwriters Laboratories, and Loss Prevention Certification Board standards processes. Armstrong also supports single source responsibility – peace of mind for occupants, insurers and owners that the equipment is built to a standard and will perform under emergency conditions.

Our customers' time is valuable to us. To assist contractors and engineers with sizing, selection, design and specification of complete NFPA20 compliant packages, Armstrong has produced the world's most versatile and complete fire pump system design software. Armstrong's ACE FP 6.00 assists our customers in generating submittals, specifications, and performance curves for a complete fire pump system in a matter of minutes. Incorporating detailed project tracking capabilities, ACE FP 6.00 allows you to share project and design information in a local area network environment or via the Internet. Files are completely transferable by e-mail to other parties participating in a project. The software and product are supported by a global group of experts able to service you in your local area. Flexible lead times are available to meet the needs of today's aggressive project completion schedules. To learn more about Armstrong Fire Pumps and Fire Pump Systems, contact your local Armstrong Representative, or visit us on the web at www.armstrongpumps.com.

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FIRE EXTINGUISHERS
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We produce the complete range of fire extinguishers portable - trolley and automatic. Any capacity and extinguishing media.

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EXTINGUISHER ROUND-UP

EXTINGUISHERS are manufactured in most countries throughout the world. They are available in many different sizes, colours, weights and are also designed for different types of fires and applications. We wanted to give you, the reader, a full market guide to the extinguishers available. However there are so many different variations, that it would fill a magazine all on it's own.

Therefore we have been in contact with many of the major global exporting manufacturers throughout the world and asked them to furnish us with their latest company and product developments. With each editorial we have printed the companies contact details so that you may make contact with them directly. We have had to be pretty selective in the editorial we have published, as space hasn't permitted us to run everything. We hope you find this look into the extinguisher industry both useful and interesting.

A.B.M VICTORIA S.P.A.

The Italian based fire-extinguisher manufacturing **A.B.M. Victoria S.P.A.** was established in 1975 and has been part of the French multinational group Société Europenne d'Extincteurs, one Europe's leaders in the fire prevention industry, since 1994.

Thanks to the large capacity of its factory located in Milan, which has three production lines for the transformation of raw material foils into full working and thoroughly checked cylinders. A.B.M. Victoria produces around 500,000 extinguishers per annum and has presence in numerous countries throughout the world. They also produce a vast range of maintenance machines and fire prevention systems, which use powder, carbon dioxide and inert gases. They also produce both portable and wheeled extinguishers, designed for many different purposes, which have varied types of approval (national, EN3, maritime use).

One of their most outstanding extinguishers is the unique **Isogard** extinguisher series. It's one of the most innovative extinguishers that the industry has seen for decades. Launched on the market after two years of extensive research focused on the needs of risk safety managers. It has also been designed for inexperienced users as well as the more experienced personnel. If used properly and without delay before the temperature and combustion fumes of a fire become un-manageable the **Isogard** range can effectively and quickly extinguish a fire. **Isogard** combines its undeniable aesthetic appearance and tamper-proof design, with an easy to understand format for use and guarantees the most effective and rapid results in use against fires, thus being the favourite of many safety-conscious customers which include airports, luxury hotels, highly populated chain stores. **Isogard** extinguishers are available with EN3 approval.

For more information, please contact:
A.B.M. Victoria S.P.A.
Fax: + 390 292 470 516
E-Mail international@abmvictoria.it

AMEREX WATER MIST FIRE EXTINGUISHER

Amerex Corporation is the only manufacturer to produce an innovative water mist fire extinguisher – Model 272.

This fire extinguisher, filled with distilled water and with a discharge of a fine water mist, is becoming the truly universal extinguisher for use in risks where Class A, chemical and electrical, risks are present.

Model 272 was originally developed for use in hospital operating theatres, where its sterile contents and fine mist discharge are ideally suited for use in these situations. Additionally, with two minor modifications, the Model 272 can be made non-magnetic, making it safe for use in MRI rooms.

Model 272 is also suitable in situations where there are stored swimming pool chemicals and where there are water miscible chemicals in areas such as funeral parlours, laboratories and veterinary surgeries. The soft discharge, zero toxicity and easy clean-up make Model 272 the preferred extinguisher.

Finally the **Amerex** Model 272 is the answer to the protection of archives, libraries and fine art collections, where its enhanced fire fighting capability, coupled with its lack of water damage or contamination, due to its use of a fine water mist, make it the only extinguisher to be used in these situations.

Model 272 is Kite marked to BS EN3 and has passed the electrical conductivity test, making it safe for use around live electrical equipment.

For more information, please contact:
Amerex Fire International Limited
Fax: +44 (0) 1633 627005
Email: sales@amerexfire.co.uk

BAVARIA EGYPT

For more than 30 years, **Bavaria Egypt S.A.E.** has been manufacturing extinguishers in the fire fighting industry. It has been able to survive due to its continuous chain of research and development, human resource enhancement and the outgoing and sustainable upgrading of man and means.

Each year Bavaria Egypt's research and development team are producing new products for the industry. Bavaria Egypt prides itself on technological advancements in fire protection equipment. Thus, they have become one of the world's most substantial manufacturers of fire extinguishers.

In recent years the company has merged with Bavaria Germany to form **Bavaria International GmbH**. Both companies had similar characteristics and features but together their new strategic proactive approach has helped them achieve one of the largest production capacities of car fire extinguishers. They also have a vast range of mobile extinguishers on 50 kg and 100 kg trolleys.

Two new products for the company are their foam extinguishers, known as **Bavaria Jet and Bavaria AFFF**. The also produce a full range of portable fire fighting trailers or mini fire fighting vehicles. These trailers range from 250 kg, 350 kg up to 500 kg. They are one of the company's hottest properties at the moment and can be found in Industry, holiday resorts, and villages in conjunction with the companies foam pump aggregate trailer units.

For more information, please contact:
Bavaria Egypt S.A.E.
Fax: +202 591 3762
E-Mail bavariad@intouch.com

EXMON

EXTINTORES MONCAYO S.L. manufacturers of the **EXMON** brand, was founded in 1993. The company manufactures a wide range of fire extinguishers. This young, dynamic company became an industry leader from the outset, thanks to a total quality management system that guarantees its products fully meet established specifications and requirements to ensure customer satisfaction.

This dedication to quality has borne its fruits and **EXMON** was awarded the **ISO-9002** Certification in the Manufacture of portable fire extinguishers and carts in January 1999, one of the first companies in its sector to achieve this.Our extinguishers are certificated according European Normative EN3/96.

Since its inception, **EXTINTORES MONCAYO S.L.** has dedicated considerable efforts to the export market and foreign sales have experienced continuous, sustained growth. Currently, **EXTINTORES MONCAYO S.L.** markets its products in Portugal, United Kingdom, France, Ireland, Malta, Jordan, Oman, United Arab Emirates, Qatar, Bahraim, Iceland, Russia and Denmark. Our visits to International Exhibitions allow us to continue seeking new markets.

In Spain, the company's turnover increases annually, achieving high market shares in many regions, making it one of the top extinguisher manufactures in the country.

For more information, please contact:
Extintores Moncayo S.L.
Fax : + 34 948 834 121
E:Mail comercial@exmon.es

GLORIA-WERKE GmbH & Co.

The economic success of modern companies is strongly characterised by the trouble free running of information technology. Downtimes, for example, of computers, servers or telephone systems caused by fires frequently mean:

High loss of sales, delivery defaults, machine downtimes, loss of image and much more.

The 19″ fire extinguisher specially designed by **Gloria** for system carriers provides high fire safety potential.

Typical Operation Ranges:

- Network and Server cabinets
- Production Control systems
- Telephone distribution cabinets
- Switch Cabinets

The 19″ Fire Extinguisher Special Features:

- The system has optional sizes for different cabinets
- Flexible use varying on danger potential
- Possibility of Alarm transmission
- Master Control Technology/Fire Alarm System Possible

Function

A smouldering fire may develop through an electrical fault in a system. The developing smoke rises up within the 19″ system rack. The **Gloria** fire extinguisher system located at the highest level of the system **(See photograph)** rack, detects this fire at an early stage by means of an optical smoke detector. The extinguisher is activated immediately and the area to be protected is flooded with CO_2. It results in the extinction of the fire without leaving any residue. Simultaneously, the integrated plug socket is disconnected. Any connected units such as cabinet fans, socket strips; computers etc. are made voltage free.

Safety

The control unit monitors the electrical lines to the fire detector and to the activation fitting of the extinguisher container. The operational readiness of the system, an alarm (activation of the system) or an interference (e.g. line interruption) are each clearly displayed by an LED. In addition, a potential-free contact for an alarm or an interference transmission to a building control technology etc. is available.

If the fire detection of the fire extinguisher system is impaired due to the suction of the developing smoke by ventilation systems prior to it's detection by an integrated smoke detector, an external smoke detector may be optionally installed at an appropriate position in the main airflow. The 19″ fire extinguisher with 0.75 kg CO_2 container can be expanded at any time by a second 0.75 kg CO_2 container. If the space to be protected is more than 2 m^3 then a fire extinguisher with 1.5 kg CO_2 container will be adequate. A consultation with your Gloria specialist will tackle any large area cabinet's needs.

Fore more information, please contact:
Gloria-Werke GmbH & Co.
Fax: +49 2523 77 295
E-Mail feuerloscher@gloria.de

NAFFCO FE 36 EXTINGUISHERS

NAFFCO has recently introduced new FE36 extinguishers, the very best Halon 1211 replacement. FE-36 has zero ODP and is listed in the registers of EPA, SNAP & AFPA 2001. Its LOEL is 15%, which is substantially higher than the extinguishing concentration, which is set to 5.3%.

NAFFCO manufactures fire extinguishers with FE-36 from Dupont USA. Extinguishers are manufactured as per BS EN# in a plant certified to ISO 9001 standards for quality. FE-36 is generally recommended for use in areas requiring clean extinguishing properties like museums, art galleries, electrical rooms, telephone exchange rooms, computer installations, industrial process control rooms, data/document storage areas, electronics manufacturing areas, communication installations, laboratories, households, aircrafts, cars, motor boats, military vehicles and trucks.

NAFFCO WET CHEMICAL EXTINGUISHERS

Fires involving cooking materials such as grease, fats and oils, have long been the cause of property loss, injury and death. NAFFCO wet chemical extinguisher is an innovative product specifically designed to fight deep fat fires in kitchens. It is effective on class A and class F fires. The wet chemical extinguishers are manufactured as per BS EN3 and BS 7937 standards in a plant certified to ISO 9001.

Fore more information, please contact:
National Fire Fighting Manufacturing Co Ltd
Fax: +971 4 8816229
E-Mail natfire@emirates.net.ae

OPTIMAX EXTINGUISHER RANGE LAUNCHED

Optimax, a new premium range of fire extinguishers, has been launched by **Thomas Glover**, the UK's leading supplier of equipment to the fire industry, and coincides with the introduction of the company's new user-friendly fire safety catalogue.

The new range – the biggest offered to the trade by one supplier – builds on the success of the former series 2000 range, which it replaces. It includes a comprehensive selection of water, foam, powder and carbon dioxide extinguishers for general fire risks as well as the specialist **Optimax** 'wet chemical' extinguisher for cooking oil fires and special powder extinguishers for metal fires. The range also includes highly polished stainless steel extinguishers.

All **Optimax** extinguishers are supplied factory filled, have been designed for ease of service and other improvements include brass valves for added strength. Further information is contained in a brochure now available for independent fire traders to order.

Our **Optimax** extinguishers are kite marked and bear graphics and colour coding in line with European standards to indicate clearly for which types of fires they are suitable.

The 100-page trade catalogue provides a streamlined and easy-to-use reference to a very comprehensive range of fire fighting equipment and includes spare parts, signs and ancillary equipment.

For more information, please contact:
Thomas Glover Ltd
Fax: +44 (0) 161 654 4317
Email: tgsales@thomas-glover.co.uk

NAFFCO

LEADER IN FIRE AND SAFETY

Our Range...

- Dry Powder Fire Extinguishers
- Carbon Dioxide Fire Extinguishers
- Water Fire Extinguishers
- Foam Fire Extinguishers
- FE-36™ Clean Agent Extinguishers
- FM 200 Fire Extinguishing System
- Carbon Dioxide Extinguishing System
- Foam Concentrates
- Fire Retardant Paints
- Fire Pump Sets
- Fire Doors
- Fire Vehicles
- Fire Hose Reels & Cabinets
- Emergency Luminaires
- Fire Detection System
- Sprinkler System
- Fire Blankets
- Fire Hoses & Couplings
- Branch Pipes & Nozzles
- Dry/Wet Riser Equipment
- High Pressure Cylinders

National Fire Fighting Mfg. Co. - ***Organisation***

NAFFCO based in Dubai, is a part of a larger group engaged in the manufacturing of fire fighting, fire protection and fire detection systems in the Middle East. We have made our strong presence felt in the Middle East, Africa and have a good number of agents world wide.

Quality *means performance*

NATIONAL FIRE FIGHTING MANUFACTURING CO. LTD. is certified to ISO 9001 Quality System by Loss Prevention Certification Board, U.K. and Bureau Veritas Quality International. Quality assurance is of paramount importance in NAFFCO's priorities.

International *alliances*

Our expertise/professionalism in this field has resulted in International leaders favouring alliances with an objective of providing the best services to the customers.

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Tel: (971 4) 8816653, Fax: (971 4) 8816229
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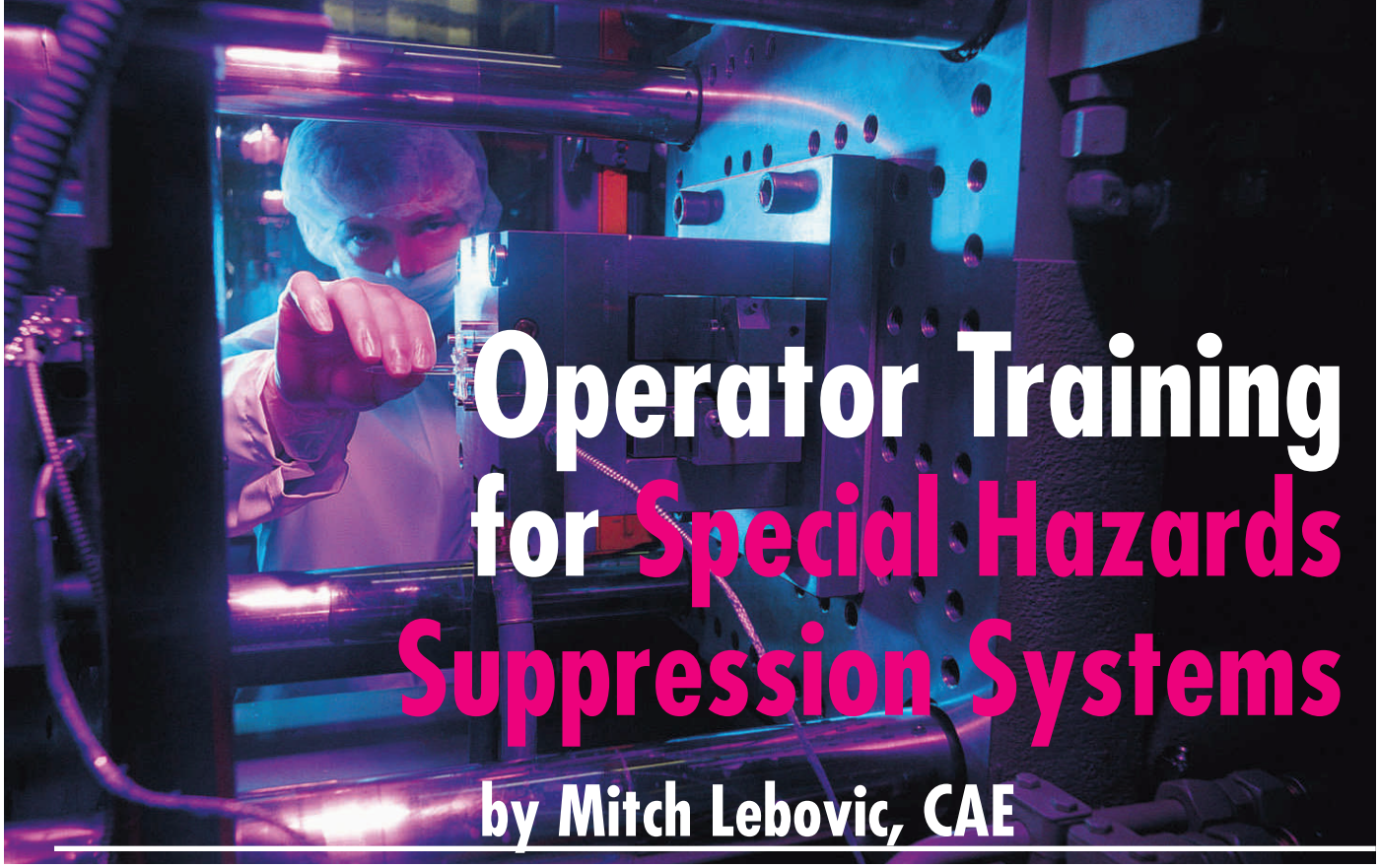
For Trade Enquiries Contact:
MR. WALID AL KHATIB

Enquiries: natfire@emirates.net.ae



Operator Training for Special Hazards Suppression Systems

by Mitch Lebovic, CAE

One morning last June, four women were working in a Midwestern insurance company's computer room. Elsewhere in the building, an electrical contractor was removing conduit as part of a remodeling project.

Assuming the entire conduit had to go, the contractor began to cut. As he worked, alarms started to blare in the computer room and a cloudy gas began to fall from the ceiling.

Panic swept over the employees in the computer room. Certain they were going to suffocate, they headed for the door. The gas made it difficult to see and some of the employees began to hyperventilate. One fell on her way out of the room and began to vomit – a physical reaction brought on by the panic. The fallen employee's co-workers returned for her and dragged her from the room.

Outside, other employees who heard the alarm came to see what was happening. They saw a body being dragged from what they assumed was a deadly gas discharge, began to panic themselves and ran screaming from the building. Two floors of a downtown high rise were completely evacuated. Emergency vehicles filled the street below and the media was on the phone to the system installer demanding to know why anyone would put a deadly gas in an occupied area.

As it turns out, the contractor cut the manual pull circuit to the fire panel. That triggered the release of the Halon fire suppression system protecting the computer room. The employees, of course, were never in any danger and the whole incident should have been avoided.

MITCH LEBOVIC, CAE is director of communications for the Fire Suppression Systems Association in Baltimore, Md. You can visit FSSA online at www.fssa.net.

EDUCATE, EDUCATE, EDUCATE

There are two glaring problems with this scenario. First, there was a contractor working in the area who was not adequately informed about the fire suppression system. That mistake alone cost the company dearly.

"An unnecessary discharge can be very expensive depending upon the agent," says George Krabbe, chairman of the board of Automatic Fire Controls in South Holland, Ill. "If you have a 1,000-pound system and gas costs $30 per pound, you've lost $30,000 just in

Picture courtesy of FSSA.

A new dimension in fire protection

AutroSafe SelfVerify - the only fire alarm system that checks itself!

Time consuming inspections are a thing of the past
Up to now, fire alarm systems have depended on manual inspection and testing, something which has resulted in a variety of problems. For example, the detectors may have been out of reach; service engineers may not have been allowed access to certain areas; or the detectors may not have been installed in accordance with the diagram….

AutroSafe SelfVerify solves all these maintenance problems. Time-consuming, difficult and costly manual inspections are no longer necessary. The system does the job for you.

We've called the technology "SelfVerify" because the system verifies itself.

Response and sensitivity test
AutroSafe SelfVerify not only tests whether a detector is capable of giving alarm, it also verifies on a daily basis the sensitivity of each individual detector using a calibrated signal. The system ensures that each detector will always respond at the correct alarm level.

Optimal round-the-clock detection
This new technology represents the safest and most reliable fire alarm system ever developed – a system that ensures optimal detection 24 hours a day!

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E-mail: info@autronicafire.no – www.autronicafire.no

AUTRONICA FIRE AND SECURITY

Operator Training for Special Hazards Suppression Systems

gas. Add in the labor to recharge the system, and that accident could easily cost $35,000."

With Halon 1301, there are environmental concerns as well. Because Halon 1301 is a potential ozone depleter, the Environmental Protection Agency has mandated a goal of zero for accidental emissions. Education of everyone working around Halon systems, even contractors there for a short time is critical to meeting this goal.

"The majority of our false activations are the result of this type of issue," says Shawn Mullen, executive vice president of Protex Central, Inc. in Des Moines, Iowa. "Systems discharge because contractors go into the room and start projects completely oblivious to the fire suppression system in place and how it operates. They start cutting, soldering or making dust without thinking about the smoke detection system. Then, all of a sudden, you have discharged the system."

It's the responsibility of the system's owner to make contractors aware of how it operates. That includes contractors that might be changing servers or pulling cables as well.

If contractors regularly work in the protected area, a temporary bypass switch might be something to consider during the system's construction.

INFORM YOUR EMPLOYEES

The second glaring problem with the scenario that opened this article is that the employees working in the room had no idea what was happening.

"The people working in a protected area are your first line of defense. They need to understand the fire suppression system," says Krabbe. "If you get a first alarm and don't do anything about it, the system may go into second alarm and release the agent."

"That release might not have been necessary had someone responded with a portable extinguisher or by resetting the panel," he continues. "It isn't necessary for these systems to discharge every time the first alarm goes off if people respond properly."

In our scenario, of course, the

Picture courtesy of FSSA.

Operator Training for Special Hazards Suppression Systems

employees didn't have a first alarm. But had they been better informed, they would have been spared the panic and discomfort.

WHAT EMPLOYEES SHOULD KNOW

When a fire suppression system goes into alarm, it is critical that employees respond properly not only to save money, but also to avoid circumventing safety features built into the system. Most fire suppression systems are customized for the hazard they protect, but Mullen cites four common system components that should be part of the educational process. First, there is some type of initiation component – smoke detectors, heat detectors or manual pull stations – that provides input for the system. Employees should know where these devices are and how they work.

Those initiation devices go into a control panel that interprets the input and powers the system.

"Somebody should look at that panel every day to make sure the proper lights are on, and he or she should know how to respond if they're not – even if that just means making a phone call," says Krabbe. "The only lights you see if everything is okay are green lights. If you see anything else, you need to act."

The third thing employees need to know is the result of the control panel's decision.

"Will it light a light? Honk a horn? Ring a bell?" Mullen asks. "Is it going to close dampers, shut down air handling units or throw voltage? Is it going to release the agent?"

Forewarned is forearmed for employees who may panic when they don't understand what's happening.

In addition to knowing what these results mean, employees need to know how to react. Should they tend to the problem? Call someone? Evacuate? Each system has different protocols. NFPA standards require system installers to provide detailed training and documentation when the system is commissioned, but it's up to the owners to maintain that training as new employees come in.

Picture courtesy of FSSA.

Finally, employees should understand the extinguishing agent that might be discharged. For example, if it's a clean agent system, they need to understand that the system is designed in accordance with standards that ensure a non-toxic atmosphere during discharge. However, if it's a carbon dioxide system (not frequently found in occupied spaces), the employees need to understand the safeguards in place and what they need to do should the alarms start sounding.

SYSTEM MAINTENANCE

The next component of a training program should involve system maintenance. Employees responsible for the system's operation should know how it needs to be maintained.

For clean agent systems, the National Fire Protection Association requires that cylinders be verified for weight on a semi-annual basis to make sure that the agent is not leaking and there is no damage. This should not be done by company employees.

"Any service and maintenance needs to be done by a company authorized in the service and maintenance of the equipment installed," says Charles Willms, P.E., technical director for the Fire Suppression Systems Association. "Fire suppression cylinders are pressurized and pose a threat to life, health and property if not handled properly."

Most companies that design fire suppression systems will also service them in accordance with NFPA standards. There are maintenance requirements not only for the cylinders, but the detection and control systems as well. Someone in the company needs to be aware of these requirements and be sure that a qualified contractor is called to do the work.

GOOD HOUSEKEEPING

Along with maintaining the system, somebody on staff should be aware of how to maintain the area around the system.

"Housekeeping is a significant part of system maintenance," says Mullen. "It's important to clean out sub-floors, make sure that air handlers aren't spewing oil on the detectors and other such things. Training, maintenance and housekeeping really are the final component of good fire protection."

PROTECT YOUR INVESTMENT

"If the personnel know what's going on in that room, the business has the best possible fire protection for that hazard," says Mullen. "By ensuring knowledge of how the system operates and under what conditions it operates, the business is helping to preserve its fire protection investment."

"Neglect, on the other hand, sews the seeds of the system's demise," he continues. "By creating apathy and ignorance, you increase the chance of an unnecessary discharge. When something like this occurs and people aren't trained for it, they panic and bad things can happen."

"Fire suppression cylinders are pressurized and pose a threat to life, health and property if not handled properly."

Pump controller courtesy of Joslyn Clark Controls, Inc.

Fire Pumps & Controllers

by DICK SCHNEIDER, Consultant Engineer at Joslyn Clark Controls, Inc. and DAVE GODDARD, Design Engineer at Pentair Pump Group.

ONCE SPRINKLERS "pop" from the heat of a fire, suppression generally depends on the quick response of the system to deliver sufficient water to douse the fire. If the municipal system water supply is judged insufficient a fire pump will be mandated. Commanding that pump to start and run at the appropriate time requires reliance on the controls and the driver, which is coupled to that fire pump. Failure of that coordinated system to respond expeditiously and reliably will result in damage or destruction to the premises being protected and possible injury or loss of life to the inhabitants therein. This life-safety equipment is designed, built and tested for performance requirements more stringent than what industrial and commercial standards require. Let's discuss the fire pump controller and then the fire pump.

FIRE PUMP CONTROLLERS

Over the ages, fire pumps have been driven by human or animal effort, steam, internal combustion engines and electric motors. Most new installations in public and private premises use diesel engines and electric motors as drivers of fire pumps.

Diesel fire pump controllers and electric fire pump controllers are designed, built and tested to various private, national, regional and industry standards. A proposed international standard, IEC 62091, now being circulated to the world's National Committees for Comments, is nearing completion.

Ideally, a fire pump controller is like a mousetrap ready to snap shut when triggered. An automatic electric fire pump controller executes a DRIVER-START upon sensing a pressure drop or receiving a sensor signal which, in the USA, is mandated to be via the opening of a normally closed contact on the fire protection equipment. That action is the electrical equivalent to sprinklers, which are normally open valves mechanically held blocked by a thermally reactive component.

Standards affecting Industrial Motor Controllers are based on Safety to personnel and equipment – essentially a "no start – no run" unless every sensor and interlock is "permissive". Circuits are designed so that anomalies such as broken wires, shorts or ground faults etc. will prevent a start of continued run.

Not so for Fire Pump Controllers! In the event of fire, starting & keeping the pump going to fight the fire is paramount. Shutting the pump down for routine protective reasons could merely dedicate it for destruction by the very fire it is supposed to suppress. That is why Standards, including proposed IEC 62091, considers electric conductors and some equipment supplying power to the fire pump motor sacrificial in favor of keeping a distressed system going. With the same philosophy, the fire pump controller is mandated to default into a start-and-run under anomalies – quite opposite to industrial motor controllers. In support of that concept, here are some of the mandated, unique requirements for electric fire pump controllers:

Fire Pumps & Controllers

A Failure of any external circuits (open or short circuit) shall not prevent operation of the pump from all other internal or external means. Breakage, disconnecting, shorting or the wires of loss of power to these circuits can cause continuous running of the fire pump but shall not prevent the controller from starting the fire pump due to causes other than these external circuits.

B The controller shall have no provision for the connection of remote stop buttons.

C Overcurrent-sensing elements must be of the non-thermal type.

D Only Locked Rotor and Short Circuit protective devices having no thermal memory affecting reset time are permitted.

E No undervoltage, phase-loss, frequency-sensitive or other sensors may be incorporated that automatically or manually prohibit actuation of the motor contactor.

F The controller shall be equipped with an emergency-run handle or lever that operates to mechanically close (& latch) the motor-circuit switching mechanism.

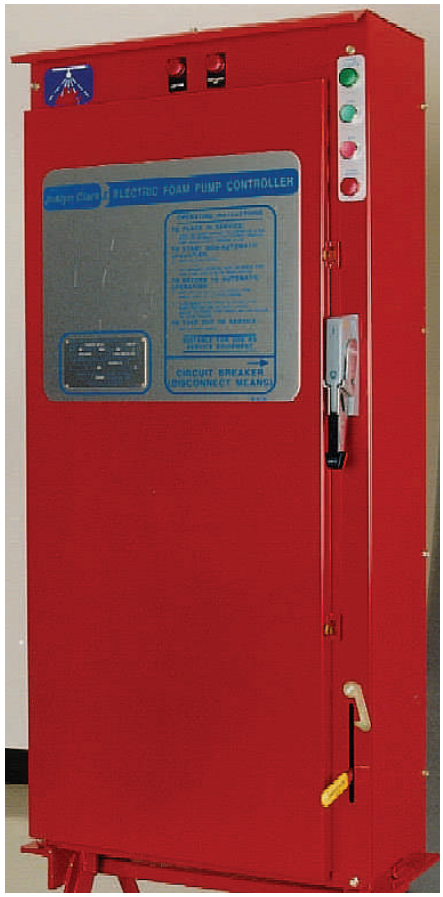
G The short circuit protective device may be set up to 20 times MFLC (which is often higher than permitted by local Requirements.

Diesel Fire Pump Controllers are designed to start, stop and monitor the diesel engine. Most DFPC's also include battery chargers to insure that both battery banks are quickly charged and maintained to be available for starting the diesel engine. They include provisions to automatically exercise the diesel engine weekly and run it for 30 minutes and then, unless other starting causes exist, automatically shut the engine down. They monitor engine temperature and oil pressure and alarm when limits are exceeded. If started for other than for test runs, the controller will not shut down the engine on high coolant temperature nor loss of oil pressure for the same reasons that the electric controller will not provide overload protection for the motor. The distressed engine, like the distressed motor, is considered sacrificial in favor of starting or prolonging the operation of the fire pump. The only condition for which the controller will shut down the diesel engine is on "overspeed" where a run-away engine becomes a danger to operating personnel in the pump room.

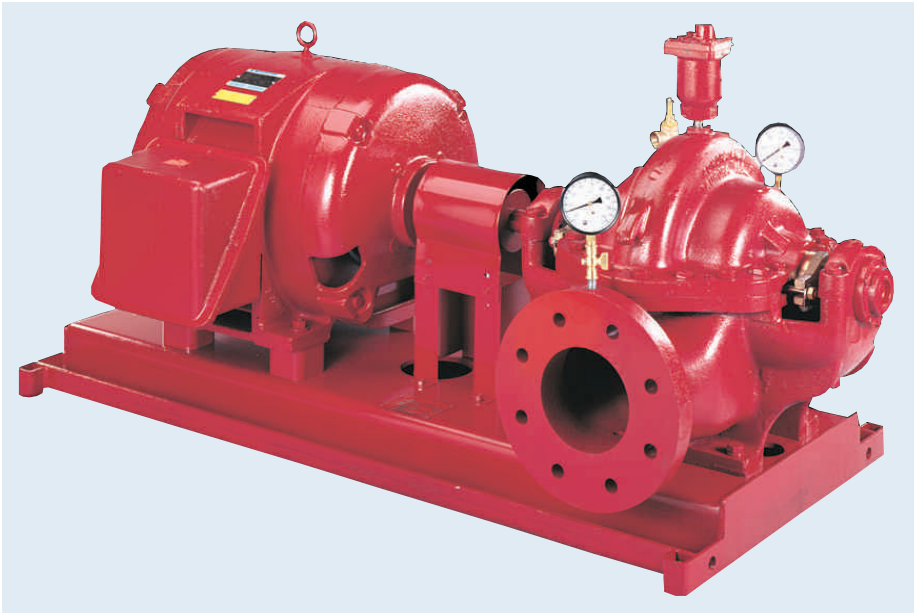
FIRE PUMPS

The Fire Pump is one of the key components of a fire protection system that requires careful selection and attention. Lives and millions of dollars of property all rely on these pumps being properly selected, tested and performing to meet the system requirements. However, not every pump can be safely used in a fire pump system. Unlike commercial pumps, a qualified Fire Pump is based on the standards and specifications established by the National Fire Protection Association (NFPA 20), Factory Mutual (FM) and Underwriters' Laboratories (UL).

In order for a Fire Pump to be in compliance with NFPA 20 and listed by independent agencies such as Factory Mutual and Underwriters' Laboratories the pumps must go through rigorous inspections and testing prior to being listed for a rated capacity and speed. These capacities and speeds for which Fire Pumps are listed will range from 25 gallons per minute through 5000 gallons per minute with net rated pressure of 40 psi or more depending



Pump controller courtesy of Joslyn Clark Controls, Inc.



Fire pump courtesy of Pentair Pump Group.

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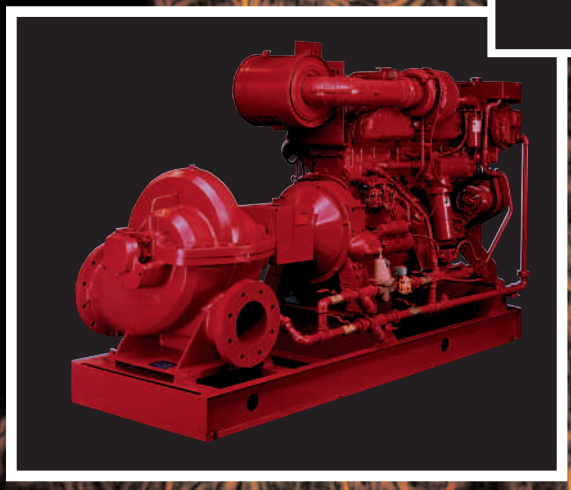

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Fire Pumps & Controllers

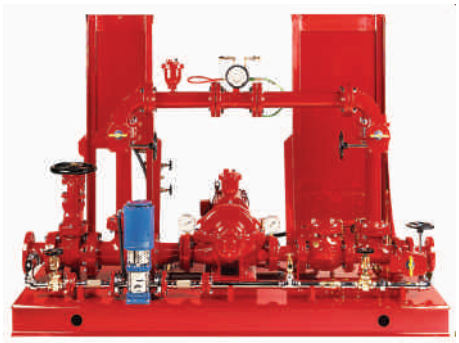
on the pump size and type. The speeds for a listed Fire Pump will vary depending if the unit is electric or diesel driven. An example of a typical electric driven Fire Pump would include speeds of 1770 and 3550 RPM while a diesel unit could have speeds of 2100 and 3000 RPM. In many cases a single pump can be listed for more than one set of conditions and speeds, however, each set of condition points and speed must be tested to meet all performance and design criteria as if it were a different pump. Each time a Fire Pump is sold for a listed capacity and speed that pump is given a performance and hydro test at the pump manufacturer's plant, to certify the conditions in which that pump was listed for. Once a Fire Pump has been shipped and installed, the pump is re-tested in the field to verify the testing performed at the pump manufacturer and to assure the pump meets the performance as shown in the listing guide as published by the independent agencies.

In addition to their listed condition, Fire Pumps must also be tested and certified at the factory and in the field to deliver not less than 150 percent of rated capacity at not less than 65 percent of total rated head. In other words, if the pump was rated for 1000 gallons per minute at 100 psig the pump must also be designed and tested to meet a design point of 1500 gallons per minute at a discharge pressure of not less that 65 psig. These two points will set the operating range of the Fire Pump, including having a shut off or churn pressure as it is commonly known that can not exceed 140 percent of rated head, regardless of pump type. These characteristics and the fact that a Centrifugal Split Case, End Suction or In-Line Fire Pump are required to operate with water being supplied under positive pressure makes up the design requirements of a Fire Pump.

Listed centrifugal Fire Pumps can be a different type, depending on the application and space requirements, these might include Vertical Turbines, Horizontal and Vertical Split Case, Horizontal End Suction and Vertical In-Line; however, the most common are the single stage Horizontal Split Case Pumps. The Horizontal Split Case has a long history of being used for fire service applications providing reliability of performance covering a full range of listed capacities and speeds. These pumps are characterized by the easy access to all-working parts, rugged construction and efficient operation. They are specified when the source of water is located above the surface of the ground providing a positive suction pressure to the pump at all performance points. The Split Case pumps can also be built in a vertical position to save valuable floor space.

Vertical turbines type pumps also cover a wide range of listed conditions and are recommended for fire pump service when the source of water is located below the surface of the ground and the pump will need to operate with a suction lift. The rotating impellers are suspended from the pump head by a vertical shaft within a column pipe that also serves as a support

Fire pump courtesy of Pentair Pump Group.



Fire pump courtesy of Pentair Pump Group.

for any line bearings. The pump can be installed in bored wells, or used to lift water from open sumps, lakes, streams, and other sub-surface sources.

Other types of centrifugal Fire Pumps such as Horizontal End Suction and Vertical In Line pumps are also used for Fire Pumps, which in some cases can provide a space and cost savings; however, they are limited on the capacities that have been approved for Fire Pump service.

Most centrifugal Fire Pumps are supplied to the sprinkler industry in a standard bronze fitted construction consisting of a cast iron casing, bronze impeller, carbon steel shaft, bronze sleeves and packing. These pumps can be supplied in different materials to meet a variety of applications; however, changes in material could affect the performance, cost and listing of the pump.

In addition to the Fire Pump, the Fire Pump manufacturer can also supply various accessories, which are required for all Fire Pump installation. Specific needs vary depending upon the requirements of local insurance authorities as well as the individual installation. The National Fire Protection Association (NFPA 20) does require that the pump manufacturer, where necessary, supply certain components as part of the standard Fire Pump system. These standard accessories include suction and discharge gauges, automatic air release valve and circulation relief valve.

Regardless of the type of Fire Pump, capacity, speed or driver required for your application, the key is to only select and purchase equipment for fire protection that has been listed by independent agencies and complies with NFPA 20. The Fire Pump manufacturer can help to assure the proper equipment has been selected and supplied in order for your pump to perform in those critical situations.

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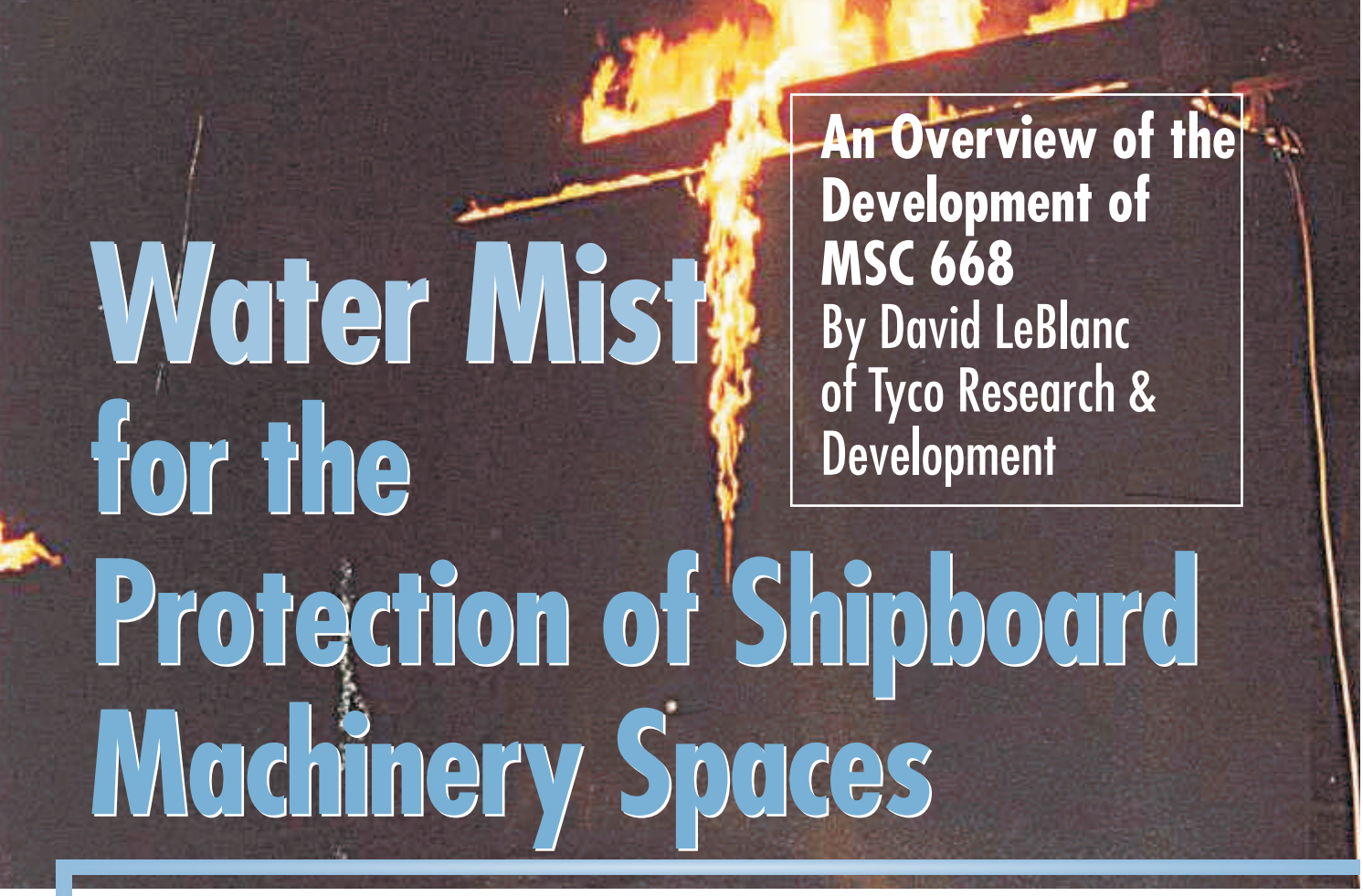


Water Mist for the Protection of Shipboard Machinery Spaces

An Overview of the Development of MSC 668

By David LeBlanc of Tyco Research & Development

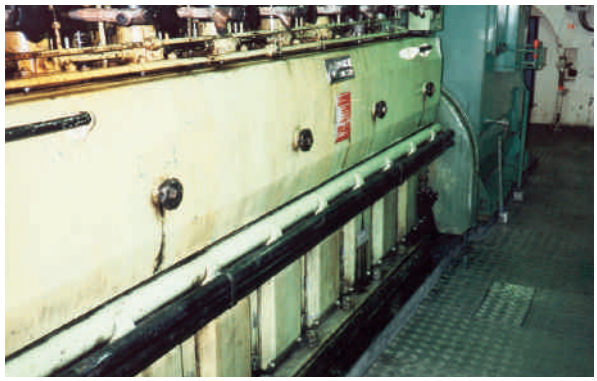
THE FIRE PROTECTION ADVANTAGES of small water droplets have been known for nearly 100 years, but only within the last decade has this form of fire suppression been brought to practical reality. The use of water mist for fire protection was first demonstrated by early and largely unsuccessful attempts to protect lumber drying kilns and cargo holds with steam in the early 1900s. Despite repeated attempts during the last century to develop efficient, effective water mist systems only in the last decade has the financial incentive required to devote serious effort to this technology been available. The renewed interest in water mist can be directly attributed to an action completely unrelated to the fire protection community, the ratification of the Montreal Protocol on Substances that Deplete the Ozone Layer.

The document developed in Montreal during the historic 1987 summit has had a profound impact on the protection of a broad range of highly challenging hazards. For decades, nearly any hazard for which water was judged inappropriate or ineffective could be easily protected with Halon. The elimination of chlorofluorocarbons, including the important extinguishing agent Halon, was a cornerstone of the Montreal Protocol. This resulted in one of the most concentrated research efforts in the history of fire protection, with government agencies, universities, and private industry all working feverishly to develop cost effective, environmentally friendly alternatives to Halon. As the theoretical advantages of small water droplets had long been known, one of the potential Halon replacement agents that received the greatest attention was water mist.

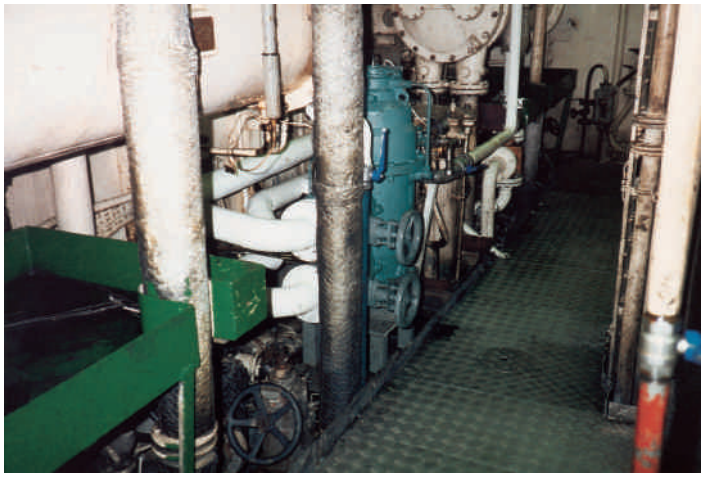
The water molecule is, for all its simplicity, one of the most astounding compounds found in nature. As an extinguishing agent, it has no rival. Water has a very high latent heat of vaporization, allowing a given quantity of water to absorb substantially more heat than an equivalent quantity of practically any other extinguishing agent. Further, when a water droplet vaporizes its volume expands more than 1600 times displacing oxygen necessary for sustained combustion and contributing to the fire suppression process. The chemical stability of water prohibits the formation of dangerous byproducts during application to a burning surface. Finally, water is the ultimate environmentally safe agent, and you simply can't beat the price!

The International Maritime Organization (IMO), while developing the Safety of Life at Sea (SOLAS) requirements, acknowledged that an uncontrolled fire aboard a ship could not be tolerated under any circumstance. This position was re-enforced by the tragic fire aboard the Scandinavian Star on April 7, 1990 during which 158 people lost their lives.[1] While traditional sprinkler systems had been required in accommodation spaces (cabins, corridors, storage rooms, etc.) for years, most of the machinery spaces such as engine rooms, generator rooms, and other areas with a flammable liquid as the primary hazard were protected with Halon.

In 1991, the 59th session of the Maritime Safety Committee (MSC) of the IMO instructed the Sub-committee on Fire Protection to review the regulations on "Automatic sprinkler, fire detection and fire alarm systems". Over the next two years, working groups were established under the fire protection sub-committee and many draft documents were prepared. One of the draft standards developed was entitled, "Test method for fire testing equivalent water-based fire-extinguishing systems for machinery spaces of



Shipboard engine room courtesy of Tyco Research & Development.



Shipboard engine room courtesy of Tyco Research & Development.

Category A". This became, for all practical purposes, the draft standard for the protection of shipboard machinery spaces with water mist systems. After several more years of preliminary testing, discussions, and revisions, the machinery space standard was approved and issued as MSC Circular 668 on December 30, 1994.[2]

The acceptance of MSC 668 allowed fire protection systems manufacturers to begin developing systems that would meet the performance requirements mandated within the test method. Given the substantial number of ships equipped with Halon systems that would require retrofit, as well as the number of new ships under construction, there was a significant financial incentive for companies to develop water mist systems that would meet the newly established demand. Initially, there was a strong belief that it would be relatively simple to achieve the performance requirements specified in MSC 668, but early testing proved that quite the opposite was true. The first few systems approved were limited to machinery spaces with comparatively small volumes, around 500 m^3. With machinery spaces on large container ships, oil tankers, cruise ships, and other vessels frequently exceeding 3000 m^3 in volume, these first systems were only suitable for a small portion of the total number of ships afloat.

The MSC 668 test protocol contains two major components. The first component specifies the mechanical performance requirements of the nozzles used in the system. These tests evaluate the mechanical ability of the nozzle to withstand the environment in which it is placed. Tests include resistance to clogging, resistance to heat and vibration, and a battery of corrosion tests, as well as many others. These evaluations are similar to those that have been conducted on standard fire sprinklers for many years, and were not difficult for the manufacturers to successfully complete.

The second major component of the test protocol evaluates the fire extinguishing ability of the nozzles against thirteen different fire scenarios. Each fire scenario is designed to be equivalent, albeit more severe, than an identified fire scenario in an actual shipboard machinery space. Table 1 presents the thirteen different fire scenarios that the system must extinguish to be approved for use in shipboard machinery spaces.

The performance requirements specified for water mist systems were similar to those required of Halon.[3] Most notable was the requirement that all fires must be extinguished, there were no provisions for a controlled fire as there are in nearly every sprinkler standard. When MSC 668 was first proposed, there was only a limited understanding of the behavior of water mist systems, and a general belief that the technology would ultimately provide performance equivalent to Halon. This would allow for a single media replacement for all the existing Halon systems, effectively solving the retrofit problem. Unfortunately, after a number of failed attempts to meet the MSC 668 standard, it became apparent that water mist was not going to be the idealized solution for halon

Water Mist for the Protection of Shipboard Machinery Spaces

replacement. It became all too clear that although the theoretical extinguishment mechanisms of water mist were very simple to understand and well known, the economical generation of a volume of mist that would behave in this idealized fashion was going to be very difficult to achieve. Nearly all of the theoretical models developed to predict extinguishment (such as exhibited in reference 4) assume a uniform volume of stable droplets with a narrow size distribution range, and very small mean droplet diameters. In practical application, the range of droplet sizes is much larger, the average size is larger, there are substantial density variations within the mist volume, and droplets interact with each other, causing size changes over time. All of this results in a very complex system that does not behave in the optimally efficient manner first envisioned.

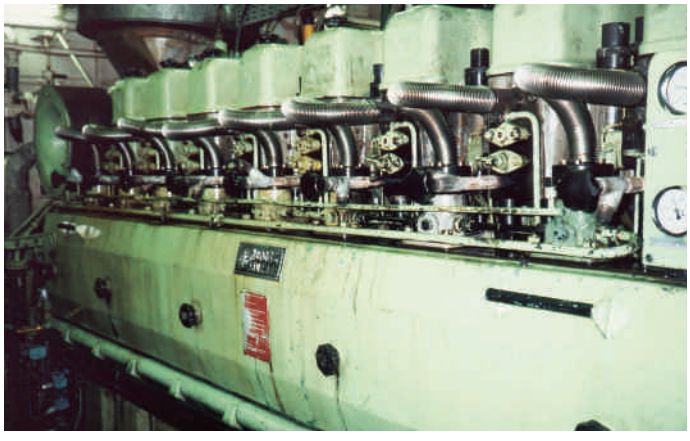
Because of the difference between theory and practical implementation of water mist, extinguishing all of the fires required in MSC 668 in the large machinery spaces proved very challenging for early water mist systems. In particular, it was found that small, obstructed fires in large, highly ventilated spaces were difficult to extinguish because the obstruction prevented a substantial quantity of mist from reaching the fire, and the ventilation and size of the enclosure would not allow for any significant oxygen depletion within the test chamber.[5]

Based upon the knowledge gained from early attempts to meet the MSC 668 fire test criteria, the United States submitted a document to the IMO Fire Protection committee stating that the then current test method essentially limited systems to 500 m^3 and requested that the standard be revised. Three major revisions were proposed. The most significant of these changes was that the 0.1 m^2 shielded heptane pool fire should be increased in size to 0.5 m^2. Also proposed was that fire scenarios 4, 7, 8, and 13 would be excluded if a separate bilge fire protection system were used. The third recommendation involved changing the definition of a Class 2 engine room to allow an intermediate step between the very small engine compartments and the very large engine compartments.

Perhaps the single most critical lesson learned during early water mist development was the importance of ventilation, particularly when trying to extinguish small, concealed fires.[6] One of the touted advantages of water mist over gaseous agents was the degree of ventilation that could be tolerated while maintaining acceptable performance levels. Several experiments were conducted demonstrating that small concealed fires, which were difficult for the fixed water mist system to extinguish, could be extinguished very safely with hand held extinguishers. The water mist system was shown to aid the extinguisher and protect the operator of the extinguisher by keeping the fire size small, cooling the atmosphere and providing significant radiation attenuation. However, because the standard was nominally based on Halon equivalence, there are no provisions for fire control. Currently there is a vigorous debate over the appropriateness of requiring fire extinguishment for every scenario. Those on one side of the argument believe that requiring extinguishment in the test

Fire Tests Required Under MSC 668/728

Test No.	Fire Scenario	Fuel
1	Low pressure horizontal spray on top of simulated engine between agent nozzles	Commercial fuel oil or light diesel oil
2	Low pressure spray on top of simulated engine centered with nozzle angled upward at a 45° angle to stride a 12-15 mm diameter rod 1 meter away	Commercial fuel oil or light diesel oil
3	Low pressure concealed horizontal spray fire on side of simulated engine with oil spray nozzle positioned 0.1 m in from the end of engine	Commercial fuel oil or light diesel oil
4	Combination of worst spray fire from Tests 1-3 and fires in trays under (4 m^2) and on top of the simulated engine (3m^2)	Commercial fuel oil or light diesel oil
5	High pressure horizontal spray fire on top of the simulated engine	Commercial fuel oil or light diesel oil
6	Low pressure low flow concealed horizontal spray fire on the side of simulated engine with oil spray nozzle positioned 0.1 m in from the end of the engine and 0.1 m^2 tray positioned 1.4 m in from the engine end at the inside of floor plate	Commercial fuel oil or light diesel oil
7	0.5 m^2 central under mock-up	Heptane
8	0.5 m^2 central under mock-up	SAE 10W30 mineral based lubrication oil
9	0.5 m^2 on top of bilge plate centered under exhaust plate	Heptane
10	Flowing fire 0.25 kg/sec from top of mock-up	Heptane
11	Class A fires wood crib in 2 m^2 pool fire with 30 sec. Preburn. The test tray should be positioned 0.75 m above the floor.	Heptane
12	A steel plate (30 cm x 60 cm x 5 cm) offset 20° to the spray is heated to 350°C by the top low pressure, low flow spray nozzle positioned horizontally 0.5 m from the front edge of the plate. When the plate reaches 350°C, the system is activated. Following system shut off, no re-ignition of the spray is permitted.	Heptane
13	4 m^2 tray under mock-up	Commercial fuel oil or light diesel oil



Shipboard engine room courtesy of Tyco Research & Development.

represents an appropriate and necessary safety factor.

Those on the other side of the debate argue that the ability of water mist to protect the space exceeds that of other Halon alternatives, and that limiting the installation of these systems, because of their inability to extinguish small fires is not in the best interest of the Fire Protection community or the public at large. They argue that because gaseous agents have a finite supply, provide very little cooling, no radiation attenuation, and leak out of the enclosure over time, it is reasonable to expect that the fire always be extinguished when evaluating these types of systems. With gaseous agent systems, if the fire is not extinguished when the supply of suppression media is exhausted, the result is an uncontrolled fire.

The primary advantage of water mist over gaseous agents is the cooling ability of the water droplets. Mist systems are very effective at cooling products of combustion and non-combusting surfaces, as well as providing substantial radiation attenuation. This prevents damage to surfaces not in direct contact with the flames, and greatly increases the likelihood that a person incapacitated in the space will survive. Gaseous agents do not provide significant cooling, and with many agents the minimum concentration for fire extinguishment is above the lethal limit for humans, requiring elaborate safeguards to ensure that the system is not discharged while the space is occupied. Another advantage of water mist is that the space does not have to be tightly sealed. While all total flooding gaseous agent systems require that the space be virtually airtight, a fairly substantial degree of ventilation can be allowed when water mist is used because of the ability to provide an essentially infinite water supply to the mist system. For example, in MSC 668 the test enclosure for spaces larger than 3000 m^3 does not allow for any restriction in air supply to the enclosure (i.e. no walls). Given the difficulty of maintaining a sealed enclosure over the lifetime of a vessel, and reliability concerns with mechanical dampers and vent closers, it is not surprising that both the insurance underwriters, and ship owners frequently prefer water mist systems.

There are a number of reasons why MSC 668/728 is such important document. As one of the first rigorous water mist standards developed, much of the knowledge concerning the behavior of water mist has come from efforts to meet this standard. Further, land based standards under development such as those proposed by Factory Mutual, Underwriters Laboratories, and the new CEN standard have utilized the experience gained from MSC 668, and the standard itself for guidance. MSC 668/728 was a critical document that provided a framework which allowed equipment manufacturers to justify spending the large quantities of money that were required to begin the development of practical water mist systems, which are now being used to successfully protect an increasing number of hazards. International standards such as MSC 668 discussed will continue to play a vital role in the advancement of water mist technology by incorporating new knowledge and technology, and by providing the structure necessary to develop viable markets for the application of water mist. While the ultimate goal of developing a Halon performance equivalent remains elusive, it is clear that water mist certainly has a bright future as a highly efficient fire-extinguishing agent.

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A Name Synonymous with Glass

PILKINGTON

PILKINGTON was founded in 1826 and remained a private company until 1970 when shares were issued on the London Stock Exchange. Today PILKINGTON plc is a large-scale manufacturer of glass and glazing products for building, automotive and technical markets which, whilst maintaining its head office at the company's birthplace St Helens, is now very much a global entity. PILKINGTON generates annual revenues of £2.8 billion and has manufacturing operations in 25 countries on four continents. Over 80 per cent of the Group's sales are outside the United Kingdom.

PILKINGTON has always been a strong innovator, with many of the world's most important developments in flat glass technology having been originated by the company. The float glass process, invented by Sir Alastair Pilkington in 1952, is the prime example, and is now established as the universal method for making high quality flat glass for both the building and automotive markets.

In addition to producing float glass in volume around the world, PILKINGTON also makes a variety of value-added processed products for the building market using large-scale on-line and off-line coating, laminating, and silvering procedures as well as a range of smaller scale processes. This product range includes products that help control energy usage, insulate against noise, provide safety and security, decoration and privacy, provide all-glass facades for buildings, and solar heat control and now a new glass, which cleans itself! Within this widespread range of activities is also the volume manufacture of fire-resistant glass products, just one of the areas where PILKINGTON is a world leader with a particular specialist high performance proprietary glass technology.

INNOVATION

PILKINGTON has a clear commitment towards R&D, currently investing over £33 million per year in this activity. In addition to the float glass process, PILKINGTON inventions include energy-saving products such as PILKINGTON K Glass™; advanced bending processes for making car windscreens in complex shapes to fine tolerances; Ez-Kool™, Sundym™ and Galaxsee™ high performance solar control glass for cars; solar reflective automotive glazing; the PILKINGTON Planar™ structural glazing system; the 3R™ clean air process for reducing nitrogen oxide emissions from glass furnaces; PILKINGTON Activ™ the world's first self-cleaning glass; and the PILKINGTON Pyrostop™ and PILKINGTON Pyrodur™ advanced fire-resistant glass range. A brand new development is PILKINGTON Pyrodur™ Plus, a slimline nominal 7.5 mm fire-resistant laminate glass that easily meets the latest European fire, impact safety, and product standards, and is ideal for internal fire-resistant doors and partitions.

GLASS IN BUILDING

The wide range of modern functional glass and glazing systems now available has opened up remarkable scope for creative design in today's architecture. Transparent design from facades and roofs right through to the centre of the building is no longer a vision. It is reality.

Heat resistance: picture courtesy of PILKINGTON.

State-of-the-art glazing can now be used in high performance designs to provide a protected yet comfortable and versatile building environment founded on daylighting, brightness and clear vision, replacing solid roofs, doors and partitions which block out views and natural light with large areas of attractive high performance glass. However, with potentially restrictive fire safety regulations in mind, such design freedom is only made possible throughout a building by the availability of special high performance fire-resistant glazings.

Such fire-resistant glazings allow the building safety regulations to be met without compromising on freedom in building planning and design, and without compromising on the internal building environment. Fire-resistant glazed systems function just like any other glasses, but in the event of fire they act to limit fire spread, thus protecting property whilst providing safe access for the evacuation of occupants along protected corridors, and for fire fighters.

The type of resistance offered by fire-resistant glass is categorised under two headings: integrity and integrity plus insulation. 'Integrity' glass is defined in international standards as the ability of a specimen of a separating element to contain a fire to specified criteria of collapse, freedom from holes, cracks and fissures, without sustained flaming on the unexposed face. Glass defined as 'Insulation and Integrity' must have the basic integrity criteria together with an ability 'to restrict the temperature rise of the unexposed face to below specified levels'. This means, in a test, that the unexposed face rises on average by no more than 140°C and in any position by no more than 180°C. Because of their area of application in buildings and their chief function, fire-resistant glass also has to show resistance against impact, as assessed by standard impact tests, such as BS 6206, DIN 52337 or, looking to the future, prEN 12600:2000.

THE PILKINGTON FIRE-RESISTANT RANGE

The PILKINGTON fire-resistant glass range is specifically designed to provide consistently high levels of protection against fire across the range of performance categories required by building design and regulations, based on essentially two basic technologies: traditional wired glass (PILKINGTON Pyroshield™) and an intumescent interlayer technology which provides an opaque insulating barrier in the event of fire (PILKINGTON Pyrostop™ and PILKINGTON Pyrodur™). The focus is on fire resistance performance, consistency and reliability, with an underlying philosophy that can essentially be expressed as 'tried, tested, trusted'.

The intumescent interlayer technology employed in the PILKINGTON Pyrostop™ and PILKINGTON Pyrodur™ range is particularly effective in these respects, in addition to providing shielding from radiant heat. It is also easy with these products to provide multifunctional combinations, combining fire resistance with the full range of other performance properties normally associated with glass in building. PILKINGTON fire-resistant glasses have been

extensively tested worldwide in a range of different framing systems using a number of different framing materials, including European leading component and system manufacturers. They are available in the widest range of specification options in terms of glass sizes, appropriate glazing systems and potential final applications, which includes fire doors, glass walls, facade glazing, roofs and floors.

PILKINGTON Pyroshield™

PILKINGTON Pyroshield™ is a monolithic wired glass for use where there is a specific requirement for integrity fire protection. It is available in *Clear* and *Texture* versions, providing typically 30 and 40 minutes performance, also up to 120 minutes tested approval in certain fire-rated systems. A popular derivative is PILKINGTON Pyroshield™ *Safety* for use in applications where there is a requirement for both integrity fire protection and impact safety to Class C of BS 6206: 1981. Also available in *Clear* and *Texture* versions.

PILKINGTON Pyrostop™

PILKINGTON Pyrostop™ is a clear 'insulation with integrity' fire and safety glass that offers the highest levels of fire protection (integrity *and* insulation), whilst also maximising the available levels of natural light and visibility. PILKINGTON Pyrostop™ provides performance options for the standard test times of 30, 60, 90 120 and now 180 minutes in appropriately rated fire-resistant framing systems. Depending on the thickness it also provides impact safety according to operating standards across Europe, for example DIN 52337 and up to Class A under BS 6206: 1981.

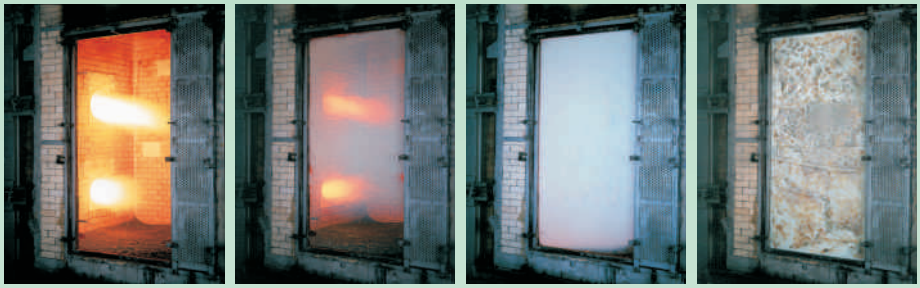
PILKINGTON Pyrodur™

A clear, laminated fire-resistant and safety glass, PILKINGTON Pyrodur™ is designed to provide integrity but also offering a level of partial insulation by protecting against radiant heat transfer. Developed specifically for use in doors and screens for the standard classification times of 30 and 60 minutes, it also conforms to relevant impact safety standards, e.g. up to Class A under BS 6206: 1981, depending on product thickness, and classification as a safety glass according to DIN 52337 (from 10 mm thick).

FURTHER ADVANCES

Continuing PILKINGTON's strong tradition of innovation, the company has just launched PILKINGTON Pyrodur™ Plus for the UK market. Designed to be especially suitable for internal fire resistant doors and partitions, the significance of this development is that it is the slimmest glass available to meet the latest CEN fire and impact safety standards.

Like other products in the PILKINGTON Pyrostop™ and PILKINGTON Pyrodur™ range, PILKINGTON Pyrodur™ Plus has a clear interlayer which foams up in the event of fire to give an opaque barrier. In the case of PILKINGTON Pyrodur™ Plus, the interlayer has been developed specifically to give reliable demonstrated fire and impact performance to the new CEN fire and impact standards (as well as the BS standards) from a product which is of only 7.5 mm nominal thickness. When exposed to the heat of a fire, the interlayer turns opaque to form an effective barrier against flames and smoke. It also reduces the level of radiant heat transmitted from the fire to an exceptionally low level for such a thin glass.



Four stages of a fire resistance test of glass – pics courtesy of PILKINGTON.

For the first time, with PILKINGTON Pyrodur™ Plus, it is possible to benefit from a thin fire glass that has many of the advantages of a thicker product. Under a series of highly successful independent fire tests, integrity was in excess of 40 minutes plus – a safety margin of at least 30% above the minimum classification time of 30 minutes. In addition to the basic integrity performance, full insulation performance was achieved for 20 minutes as well as protection against radiant heat for a period in excess of 40 minutes. Under the new CEN classification scheme the product designation is E 30 / EW 30 / EI 20. In these respects, PILKINGTON Pyrodur™ Plus represents a major breakthrough in the fire glass market.

Two of the fire tests were performed on timber doorsets incorporating PILKINGTON Pyrodur™ Plus. Test RF 00138, was conducted on a single action, double leaf timber doorset with side and over panels that comprised PILKINGTON Pyrodur™ Plus, hardwood frames, glazing beads and doors and intumescent materials incorporated into the construction. Test RF 00137 was undertaken on two single leaf, single acting glazed doors that consisted of PILKINGTON Pyrodur™ Plus, hardwood frame, door leaf and glazing beads and intumescent seals incorporated into the construction. To complete its fire test portfolio, the product was also successfully tested in a multi pane steel screen and door (Ref: WARRES 118798).

In addition to its fine fire performance, PILKINGTON Pyrodur™ Plus also complies with the impact safety standard prEN 126000, breaking safely in the manner of a laminated glass according to the provisions of the standard. Performance rating is class C according to BS6206. The glass also offers excellent acoustic insulation performance compared with other clear fire-resistant integrity glasses.

THE FUTURE

The development of PILKINGTON Pyrodur™ Plus represents a very significant breakthrough in the thin 7.5 mm integrity category. It provides a product that has long been sought by the trade and specifiers. Technical development will continue to take place but this is not the only aspect to bear in mind for the future. Other issues related to the coming introduction of CE Marking are also now on the horizon, together with a whole structure of new supporting product, classification and testing standards.

PILKINGTON places major emphasis on the pursuit of improved fire safety in buildings, and as part of this commitment provides representation on, or support to, relevant UK, European and international standards organisations and committees which impact on the use and application of fire-resistant glass. PILKINGTON also seeks to participate as appropriate in wider activities to develop fire safety principles within the fire protection industry as a whole. An example is its participation in the Fire Safety Development Group, a lobbying organisation which operates within parliamentary circles, now looking to wider involvement within Europe and supported by a number of manufacturers of passive fire protection products to secure improved fire safety protection measures across the field.

These types of activities confirm PILKINGTON's acknowledgement that effective fire protection requires a total and integrated approach, which recognises not only the importance of product performance, fitness for purpose, regulations and standards, but also the combination of different fire protection measures and technologies within an integrated fire safety concept and design philosophy.

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Intumescent Wrap Strip Firestopping Products

By RICH BYRNE of the International Firestop Council

THE FIRE PROTECTION CHALLENGE

Firestop products offer a variety of passive fire protection features for protecting opening in fire-rated walls, ceilings, roofs, doors and windows, and through-penetration firestops for items such as wires, conduit, and pipes. Passive fire protection is designed to contain a fire within the area in which it starts, and to prevent loss of life by restricting the spread of fire and combustion products

One important example of passive firestopping is the sealing of through-penetrations made in rated walls and floors for vented plastic pipes. The combustible nature of these plastic components presents a far more challenging fire hazard than is posed by metal pipe or conduit penetration because they may melt or burn and create a passage for smoke and flame to spread quickly into adjoining rooms or floors. Plastic pipes encompass a variety of materials that include PVC, CPVC, cc-PVC, ABS, cc-ABS, PVDF, PP, PB, PEX, and FRPP.

Fortunately, there are several plastic pipe firestopping options, each of which has been designed to close off plastic pipes under fire conditions so as to prevent fire and hot gases from breaching the opening in a fire-rated wall or floor. Plastic pipe firestop components consist of wrap strips, restricting collars, sleeves, and intumescent sealants.

Through-penetration firestop seals commonly rely on a property known as intumescence, which means that they expand substantially in volume when exposed to heat. Intumescent products must have sufficient and highly directional force to completely seal off combustible pipes and the voids that are created by them when there is a fire, and activate early enough to begin squeezing a pipe shut before fire can burn through the inside of the pipe.

Wrap Strips are flexible, resilient ribbons of highly intumescent firestop material used to firestop plastic pipe through-penetration applications. When exposed to heat, these products expand in volume (as much as ten times their initial volume) to form a dense char that seals the opening left by the burned or melted pipe, thus preventing the passage of flames and hot gases through the opening. This char must be hard and solid so as to resist shifting and withstand the force of a water stream.

An intumescent wrap strip is typically installed by wrapping the pipe with a specified number of layers. The number of wraps required for effective fire protection depends on the specifics of the system. Typically the larger the diameter of pipe, the more layers of wrap are required.

For example, 3-in. PVC pipe may be effectively firestopped with a single layer of wrap strip, whereas two layers may be required for a 4-in. diameter pipe. Wrap requirements are also dependent on the type of plastic in question. PVDF pipe tends to soften and melt more rapidly in a fire than PVC, and thus more wraps are required for PVDF pipes in order to close the opening more quickly.

Wrap Strips are flexible, resilient ribbons of highly intumescent firestop material used to firestop plastic pipe through-penetration applications.

Caption.

Intumescent Wrap Strip Firestopping Products

Wrap strip – courtesy of Hilti.

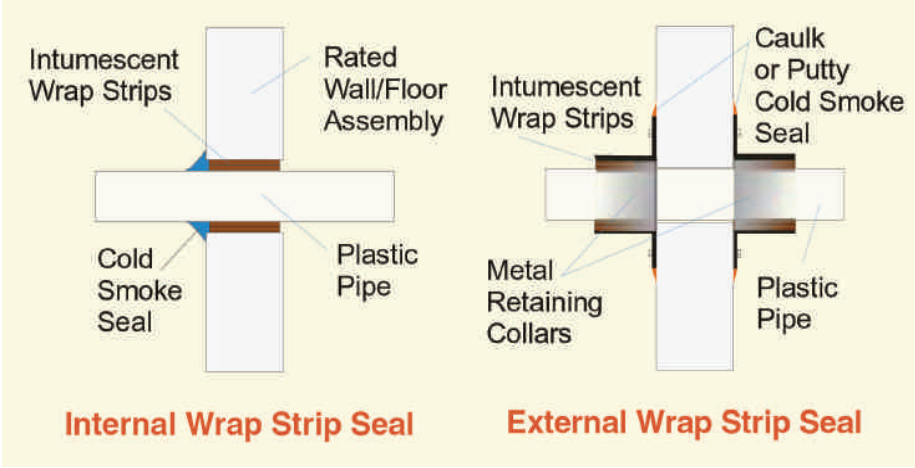

Fig. 1 A plastic pipe firestop can be installed either internally or externally, depending on construction circumstances.

INSTALLATION OPTIONS

The approved method for installation of each intumescent wrap strip product on a given diameter and plastic pipe material is covered in the pertinent U.S. Fire Resistance Directory listing for that company's product. Plastic pipe firestop systems are generally installed in one of two ways depending on construction circumstances. When there is sufficient annular space, they can be installed around the pipe, internal to the wall or floor assembly. Where annular space is restricted, they are placed externally, against the outside surface on either side of the wall or floor (Figure 1). In either case, the wrap strip material must be wrapped tightly and evenly around the pipe.

In the case of internal wrap strip installations, or "tuck-in", the expanding intumescent seal pushes against the inner surface of the rated assembly to close the opening. An externally applied firestop acts against its metal retaining collar to confine the expanding wrap strip and cause it to fill the opening left by a melted or burned pipe.

External plastic pipe firestops can be accomplished using one of several premade metal assemblies containing intumescent wrap strips, or built up by wrapping a pipe with wrap strip, and then applying a separate metal restricting collar that is bolted to the wall or floor.

In either case, the pipe must be wrapped with the required number of layers based on pipe material and diameter. For plastic pipe penetrations using the internal firestop method, the intumescent wrap is generally recessed from the surface approximately •-in. to allow for application of a rated cold smoke seal material. This smoke seal may be a silicone-based sealant, or an water based intumescent caulk. Either will restrict passage of smoke under fire conditions when the temperature is not elevated to the point of intumescent activation.

Wrap strips can be applied continuously around a plastic pipe until the number of required layers is met, or applied in individual layers with ends off-set and lapped to reach the required thickness.

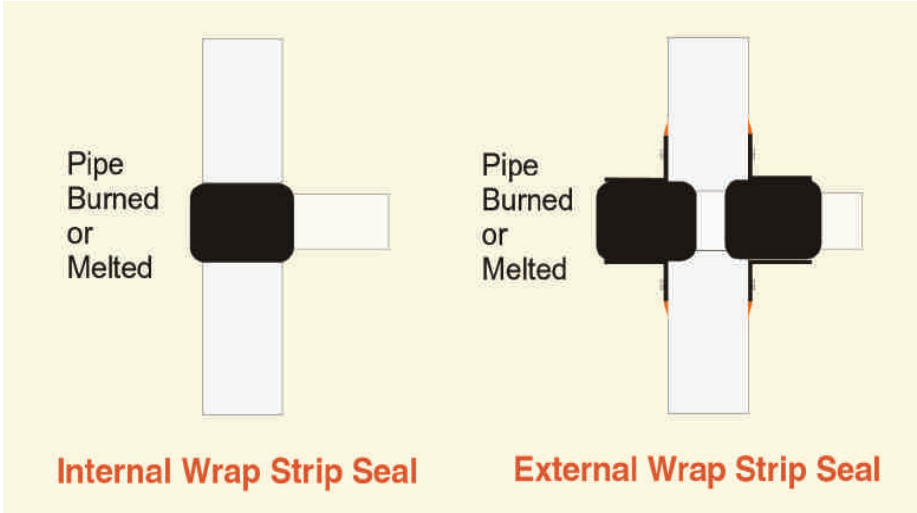

Fig. 2 In the event of a fire the intumescent wrap strip expands to fill the void left by a burned or melted plastic pipe, restricting passage of smoke through a rated partition.

TESTING

Approved intumescent firestop materials must be classified by Underwriters Laboratories and Factory Mutual, and tested in accordance with ASTM E 814/UL 1479 "Test Standard for Through-penetration Firestops". The ASTM and UL standards require that the installed product exhibit resistance to positive pressure at a minimum of .01 inches (2.5 Pa) of water. Some U.S. products also meet the requirements of U.L. Canada (CAN4-S115M), which requires that vented plastic pipes be tested with a positive pressure of 50 Pa, which is substantially higher than the 2.5 Pa required by the ASTM E 814 test method. These industry specifications define the plastic pipe material, pipe diameters, and the type and thickness of penetrated floor/wall assemblies.

Intumescent wrap strip products must be tested under UL-approved conditions to qualify the minimum number of wraps that are required to effectively firestop various types and

Examples of Plastic Pipe Wrap Strip Products*

SPECIFICATION	Rectorseal Metacaulk Wrap Strip	Hilti CP-645 Firestop Wrap Strip	WR Grace FlameSafe Wrap Strip	3M Fire Barrier FS-195+ Wrap/Strip	3M Interam™ Graphite Mat Ultra GS	Specified Technologies, Inc. SpecSeal® RED Wrap Strip	Specified Technologies, Inc. Spec Seal® BLU Wrap Strip
Dimensions	1"x1/4"x12' 2"x1/4"x12'	1"x1/4"x25' 2"x1/4"x25'	1"x1/4"x12' 1.5"x1/4"x12'	2"x1/4"x24" (foil-backed)	2"x1/8"x40'	1-1/2" x 1/4" x 12'	2" x 3/16" x 12'
Activation Temp.	375°F/190°C	375°F/190°C	250°F/121°C	300°F/150°C	410°F/210°C	250°F/121°C	250°F/121°C
Max. Pipe Dia.	Not avail.	8"	Not avail.	10"	Not avail.	Not avail.	10"
UL Fire Rating	Up to 3 hrs.	Up to 3 hrs.	Up to 3 hrs.	Up to 3 hrs.	Up to 3 hrs.	Up to 3 hrs.	Up to 3 hrs.

*For further information about other intumescent wrap strip products and other firestop product manufacturers, please consult the International Firestop Council Web site @ www.firestop.org

diameters of pipes. The resulting test data allows users to install the most cost-effective pipe wrap assembly capable of meeting firestop performance standards.

Wrap strips for plastic pipe firestopping should be approved as a Class A Building Materials, with a flame spread of 5 and a smoke development index of 5 when tested in accordance with ASTM E 84. A wrap strip product should also be UL Listed as a Fill, Void or Cavity Material, and FM approved for firestopping plastic pipes. As with all firestop products, this material should be used only as described in tested systems or as recommended in a confirmed engineering judgment by a qualified manufacturer.

PRODUCT

Options Wrap strip materials begin to expand at pre-determined temperature

As with all firestop products, this material should be used only as described in tested systems or as recommended in a confirmed engineering judgment by a qualified manufacturer.

Intumescent Wrap Strip Firestopping Products

IFC's mission is to promote the technology of fire containment in modern building construction through research, education and development of safety standards and code provisions.

levels established by each manufacturer (see Table 1), increasing in volume to 10 times or more of the original size. This material is typically provided in rolls or strips of several widths, with a common thickness of ¼ in. Wrap strip physical properties and construction also vary by manufacturer. One product is made with a foil backing, another with a polyethylene liner. The various products differ in color and appearance, but each has essentially equivalent functionality.

Users should review application requirements and published product specifications in the product selection process. Important product qualification issues include testing to industry standards, U.L. listing of applications, product shelf life, applicability to pertinent pipe materials and diameters, mechanical flexibility, aging properties (stability and performance in place), ease of installation, accessory items, availability, technical support, and training services.

For Further information on Firestopping products and a full list of Firestopping manufacturers, contact the International Firestop Council (IFC). The IFC is a not-for-profit association of manufacturers, distributors and installers of fire protective materials and systems. IFC's mission is to promote the technology of fire containment in modern building construction through research, education and development of safety standards and code provisions.

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Concrete in Fire

By David Sugden of the ASFP

There is a general perception that concrete will not burn and therefore must be fireproof, after all, at one time we used concrete to protect steel from fire so it must be so! All buildings and many other structures use the material for walls, floors and often the main frame of the building so what is the position?

Construction News, the weekly journal of the UK construction industry, carried a headline in April 1999 "Fire Fears over Concrete Floors" that was based on stories of exploding concrete in tests being run by Building Research Establishment at Cardington. In this case, the tests involved floor slabs used to construct a temporary furnace in which to undertake a large-scale fire test. During the test the concrete slabs suffered explosive spalling, showering the test apparatus with pieces of concrete. This was the result, it is believed, of residual moisture boiling and the pressure thus developed causing the spalling.

This problem has been found particularly in high strength concrete and as long ago as 1976 the American National Institute for Standards and Testing (NIST) initiated research in to the fire performance of the material. In the Channel tunnel fire in November 1996 the firemen complained that they were showered with concrete and photographs of the railcars show their roofs sagging under the weight of the spalled material.

The NIST indicate that high strength concrete (HSC) loses up to 40% of its compressive strength below 450°C and approximately 75% of its strength when heated to 600°C. Research by NIST has indicated that this loss of strength compares with 10 to 20% loss at 300°C and between 60 and 75% loss at 600°C for normal strength concrete. They also indicate that explosive spalling can be expected at temperatures between these two figures and it is interesting to consider that steel sections, when fully loaded also lose their strength at between 550°C and 600°C but do not in fact start to lose strength quite as quickly. In this matter NIST defines HSC as being "made from conventional materials, admixtures, and techniques, having specified compressive strengths for design of at least 40MPa". This is not excessively higher than the figure of 30MPa that I understand is normally specified for structural frames in the UK.

The general opinion however remains that, provided that the cover over the reenforcing bars is maintained according to BS 8110 for whatever period of protection is required, then concrete is indeed "fireproof", at least in buildings. The spalling that would be experienced because of a lack of cover of the bars and differential expansion is however much different from the explosive spalling that is causing the NIST much concern. The latter is thought to be caused by the density of the higher strength materials not allowing vapour pressure to be relieved at elevated temperatures.

TUNNEL EXPERIENCE

Explosive spalling is however a real concern to many experts when the use of concrete linings in tunnels is considered. Fires in tunnels are in fact a much too regular occurrence and the dangers are self evident to anyone who gives the matter some thought. The detection of fire, control of traffic, provision of a means of escape or safe haven, ventilation and smoke control, fire fighting and damage to the structure will all need attention immediately an incident occurs and in some rather special circumstances. There is limited access, a mechanical ventilation system; there may be limited drainage and a structure that has special dangers of collapse. It is in this latter area that we can see some convergence of expert opinion in many countries although I do feel that more work is needed if we are to optimise the safety of these special structures.

Some of the most extensive work has been done in Holland where the Rijkwaterstraat (The Dutch Transport Ministry) takes the view after much research at the TNO laboratories and on existing structures that tunnels must be protected from fire in the "worst case" scenario. Fire tests are required on an individual project basis and the tests are done to the special heating regime known as the RWS Curve. This is more severe than the hydrocarbon curve used in the petrochemical industry as is shown on the graphs and has a maximum temperature of 1350°C maintained for up to 2 hours.

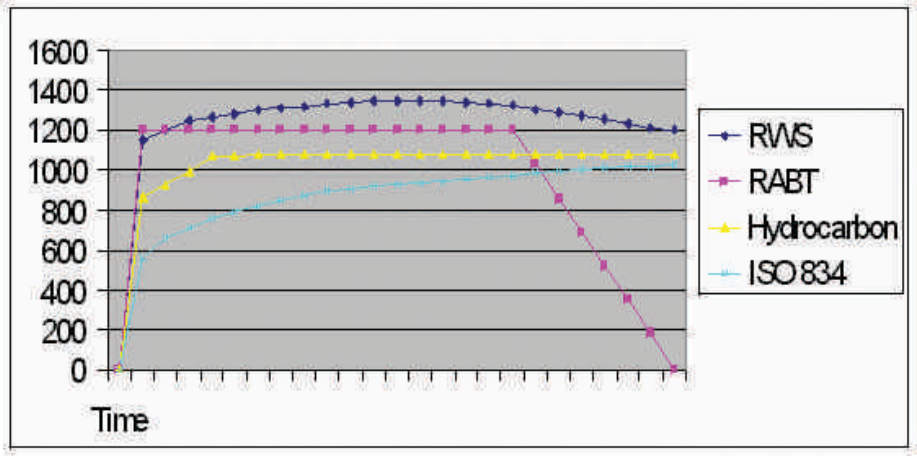
The RWS regulations look at immersed and bored tunnels concluding that some structural risks may be greater in immersed structures but there is perhaps more risk of explosive spalling in bored tunnels as the lining sections are in compression.

Under the standard rules the Dutch authorities require the surface temperature of the test piece to be restricted to 350°C and the temperature at 25 mm

Concrete in Fire

resisting boards can be either fixed to the concrete surface or formed into the surface during casting and cementitious spray materials of various types can be sprayed onto the surface.

In addition to the fire resistance



cover depth to 250°C which ties in quite well with the NIST comments noted earlier. The imposition of this temperature limit leads to a requirement for added fire protective insulation to the concrete lining and the test must show no loss of bond, failure of fixing or explosive spalling during the test. In Switzerland the surface temperature is limited to 250°C in a test with a similar heating curve.

Recent work on bored tunnels in Holland shows that explosive spalling can occur within 10/15 minutes at surface temperatures of as low as 200°C so that it is proposed to limit surface heat to 200/250°C in such structures. Where the moisture content is over 3% of the mass the risk of explosive spalling is said to be 100%. The use of high strength concrete is acknowledged to carry more risk of explosive spalling and the moisture content likely to be found in tunnel linings is said to be around 5 to 6%. Expansion of around 1700 times as water is turned to vapour will create great pressure in these materials. Research into the use of polypropylene fibres to alleviate this pressure may offer further ways of mitigation but the use of lining materials is required by the Dutch regulations to keep the surface temperature down to the quoted levels.

MATERIALS AVAILABLE

Material manufacturers offer two generic types of material for this protection. Fire requirements such materials will also have to withstand the severe suction pressures caused by passing traffic, the chemical attack from fumes and the impregnation of moisture from spray during wet weather, particularly near to the tunnel entrance. Recent contracts include the following:

The Oresund crossing where the RWS heating curve was used to test materials for the project and the length of the tunnel caused much concern when escape was considered. This tunnel was protected with a vermiculite cementitious material (Fendolite FM2) at a thickness of 26 mm. This was applied in the yard to the immersed sections after power washing the surface at high pressure. Cast in situ concrete was jet washed to remove curing agents and other contaminants and in both areas the spray material was applied without added reinforcement.

The 2.5 km long Al-Hazar tunnels in Cairo have been treated with a refactory based cementitious spray (Firemaster FireBarrier 135) that is sprayed onto metal fixing anchors at a thickness of 47 mm. This product is claimed to be capable of repeated use after fire provided it is not mechanically damaged and so cuts the cost of reinstatement.

Lining with boards requires care, as the vacuum effect can be severe on large flat objects. Techniques have been developed by Promat that allow the boards to be used as sacrificial shuttering (form-work) with the fixings cast into the concrete. Alternatively curved boards can be used to either construct ductwork or to be retrofitted to tunnel surfaces. In the Perth tunnel 27 mm boards were used (Promatect H) that have been tested and approved to the RWS regulations and used on many Continental tunnel projects. A quantity of 15.000 m^2 of the same product was used to line the Belliard/Kortenberg/Roodebeek Tunnel through which 12 million cars a year leave Brussels. In this case a decorative and easy maintenance surface panel (Glasal) was glued to the fire protection panel.

The two-hour fire protection design requires that the fans and ducts must continue to work and so passive protection of these areas and cable trays and cable ducts must also be done. The UK legislation follows international practice by requiring barriers in cable ducts at 50 metre intervals and so also requires fire-sealing materials with the same fire resistance ratings. The verge ducts are required to be resistant against a 250°C temperature for two hours in the UK documents, a requirement that many materials will meet quite easily. In the UK the decision on the use of added protection for the lining is left to the tunnel owner who must undertake a risk assessment to support his decision.

The recognition of, and continued work by the International Tunneling Association on these problems and the work some years ago in the Eureka Firetun project should bring us safer transport tunnels. Tragically the fires in recent years such as the ones in the Mont Blanc and Tauern tunnels shows that we have along way to go, traffic volumes are increasing and some existing structures may need considerable upgrading. It is not a problem that can be ignored.

There is some doubt in many experts' minds as to the cause of explosive spalling and no apparent agreement on the definition of normal and high strength concrete. The spalling is inconsistent and the NIST is calling for more research to develop an understanding of the spalling mechanism(s) and to establish predictive parameters and standard methods for its measurement. Under these circumstances the Dutch decision to work on a "worst case scenario" for their tunnels can be seen to be a wise one. With the definition of HSC rather vague and the strength levels being quoted by NIST quite close to those used in many countries for normal buildings we could perhaps seek more research into the fire performance of all concrete to match the high volume of research done in recent years into the fire performance of steel.

The Dutch decision to work on a "worst case scenario" for their tunnels can be seen to be a wise one.

David P Sugden

The RSA FORUM

The UK Fire Sprinkler Industry is currently represented by three main organisations.

- The Residential Sprinkler Association (RSA)
- The British Automatic Sprinkler Association (BASA)
- The Association of Fire Protection Engineers (AFPE)

Each organisation has quite different objectives and as a result the Sprinkler Industry is not fully represented by any one Association. Whilst the reasons for this state of affairs are historical and complicated, the need to unravel the situation and co-ordinate representation is both immediate and obvious.

BACKGROUND

The idea of using fire sprinklers for life safety in residential property is not especially new, and was first formally suggested in the America Burning report of 1973. Following successful demonstrations of residential sprinklers in Operation San Francisco in 1983 the Loss Prevention Council developed their Technical Bulletin TB14 in 1990. Although BASA initially encouraged the residential concept they subsequently withdrew their support (though fortunately times have now changed). This led to a rift in the Industry, and in due course, to the creation of the Residential Sprinkler Association (RSA), which was formed specifically to champion the life safety application of fire sprinklers.

At about the same time the Loss Prevention Certification Board (LPCB) developed a 3rd party Certification Scheme (LPS 1048). The way this scheme was structured was seen by some sectors of the Sprinkler Industry as restrictive, and this led to another rift in the Industry. As a result the Association of Fire Protection Engineers (AFPE) was formed.

So, in a relatively short period of time, the UK Sprinkler Industry was fragmented into three parts. Three parts with very different agendas; that hardly spoke to each other, if at all; and with very differing views of the Industry. Inevitably this has led to replication of effort, waste of valuable resources, and very confusing messages.

In 1997 when I suggested the formation of the RSA I did so in the knowledge that there were already (too) many representative bodies in the Fire Industry generally. At that time I identified 76 organisations. Since then several more have been created, including of course the RSA. It was only because of the reluctance of the existing organisations to support residential sprinklers that the creation of the RSA was justified. It has therefore always been one of my priorities to resolve that situation. The UK Fire Sprinkler Industry is too small to afford three representative bodies, let alone the damage done by these conflicting messages.

I therefore warmly welcome the recent thawing of relations between the three organisations. I hope that the recent meetings, and the proposed creation of the Joint Sprinkler Industry Liaison Panel (JSILP), will lead to greater co-operation and increased effectiveness all round. When JSILP first meets there will be much for it to do, but I would hope that amongst its first priorities will be . . .

CERTIFICATION

The LPCB has recently been reviewing its 1048 scheme and has also, but separately, produced a draft 3rd party Certification scheme for Residential Sprinkler installations. Whilst the RSA welcomes the LPCB's initiative, we feel that the opportunity should be between qualifications and areas of competence, and a clear upgrade path based on recognised training. This we believe will bring more sprinkler installers into the scheme (thus improving standards), and provide encouragement for new entrants to the Sprinkler Industry. Taken to streamline the whole certification concept and create one fully integrated scheme. In particular we feel there should be a direct linkage

We also feel that the current "supervised" category is divisive and can lead to restrictive practices, which although perhaps unintentional, may breach fair trading provisions. This artificial division is largely based on the ability to perform hydraulic calculations. In this day and age, with the plethora of computer programs available, this should no longer be a dividing line in a mature and responsible Industry.

We would therefore support a fundamental reappraisal of the whole 3rd party Certification concept, with a view to producing a vertically integrated scheme that caters for the needs of the whole Industry, whilst continuing to uphold the Industry's commendably high standards.

MARKETING

With the current UK market estimated to be in the region of 1.2million heads a year, the UK installs barely one tenth the number of sprinklers per head of population as does the USA. It is no accident that the substantial reduction in USA fire deaths over the past 25 years has coincided with a dramatic increase in their usage of fire sprinklers. In contrast, it is a depressing fact that the number of heads installed in the UK today has changed little since the mid-1970s. Statistics show that the death rate from fire in the UK is the fourth worst in the world, yet our usage of fire sprinklers is at best average and substantially exceeded by many third world countries.

Historically the UK Sprinkler Industry was driven by the Insurance Industry and therefore did not need to market its product. Times have changed, and this is no longer the case. The Industry must now face up to the need to sell itself and its products in an ever more competitive market. Its technology can virtually eliminate fire deaths, but it remains a puzzle why we in the UK seem so reluctant to use it. Indeed the Sprinkler Industry itself appears remarkably coy about its product, and suggestions that fire sprinklers are "Britain Best Kept Secret" almost seem justified.

I therefore personally hope that these recent moves within the Industry will result in a coordinated marketing strategy as well as a better certification scheme. Maybe in time it will also lead to a single organisation again representing the UK Fire Sprinkler Industry

Sir George Pigot

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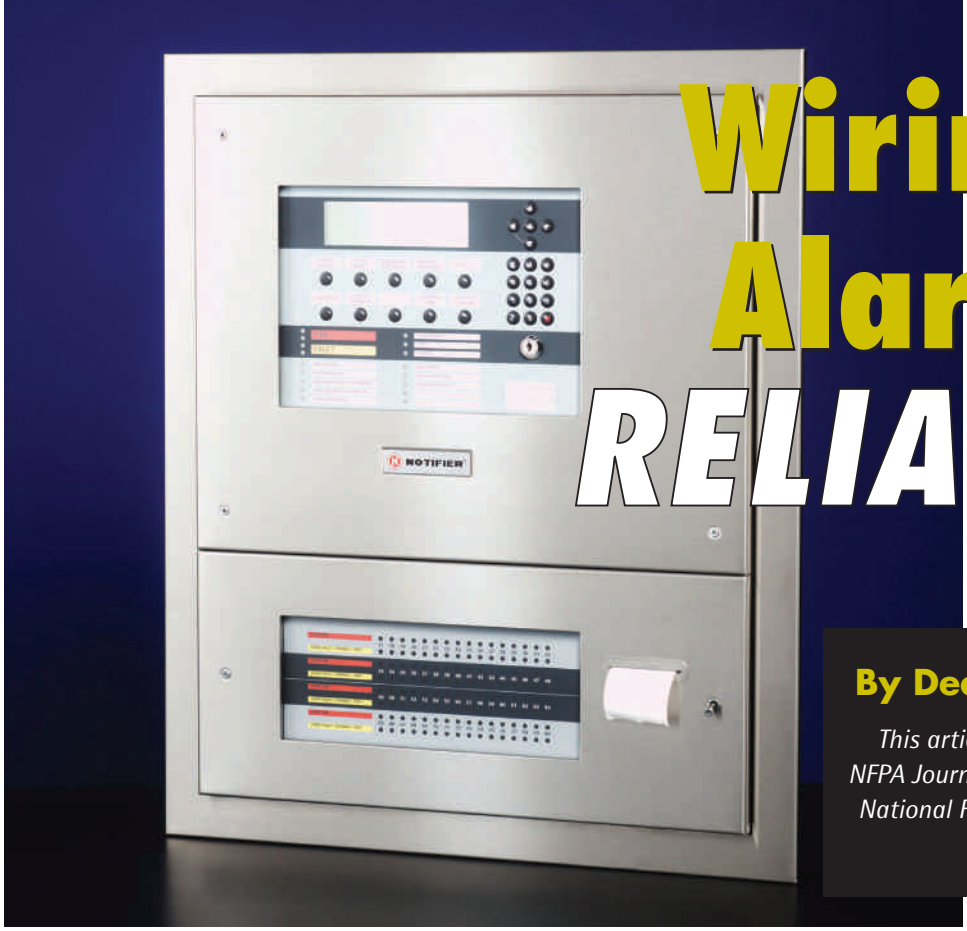


Wiring Fire Alarms for RELIABILITY

By Dean K. Wilson, P.E., CFPS

Picture courtesy of Notifier Ltd.

A fire alarm system may not work properly if the wiring isn't properly installed.

"You can follow a careful design procedure. You can select a fire alarm system control unit, initiating devices and notification appliances from a quality manufacturer. But if you don't properly install the wiring that connects the system components together, the fire alarm system for your college campus or other protected property may not work reliably."

That was the response I got when I asked Richard Kleinman, president of AFA Protective Systems, Inc. in Syosset, New York, about the role wiring plays in overall fire alarm system reliability. His response nailed it.

As the least glamorous part of a fire alarm system, the wiring receives very little hype. Consumers may agonize over their choice of every other fire alarm system component, but very few shop carefully for the wiring that will connect those components.

Likewise, authorities having jurisdiction (AHJs), including the local fire marshal, fire prevention officer, or insurance inspector, will thoroughly check the placement and spacing of heat, smoke, and flame detectors; manual fire alarm boxes; and the horns, strobes, or other notification appliances. Only rarely will they pay much attention to the nature and character of the wiring.

BASIC PRINCIPLES

The 1999 edition of NFPA 70, National Electrical Code® (NEC®), contains requirements for properly wiring a fire alarm system. While these requirements may seem daunting at first, they become quite clear once a user understands certain basic principles.

The first major thing to realize is that NFPA 72, National Fire Alarm Code®, helps ensure fire alarm system performance. The second thing is that NEC requirements provide safety against electrocution from installed wiring and help prevent the wiring from starting a fire.

Before beginning any fire alarm system project, the building's owner must first determine the desired system performance by determining the installation requirements for the particular wiring method selected.

DETERMINING CIRCUIT PERFORMANCE

Once a building owner firmly establishes fire protection goals relating to life safety, property protection, mission continuity, heritage preservation, and environmental protection, he or she can develop the specific objectives for their fire alarm system. Then, the owner's design professional will draft a set of specifications for the system. Based on these specifications, the designer will select equipment from various manufacturers and develop a suitable design.

When the AHJs have approved this design, an installer will put the system in place. The AHJ will then witness initial acceptance tests. At this point, the building owner will begin to use the system and provide for periodic testing and maintenance.

As part of the specifications, the designer will determine the performance expected from the initiating device circuits, the signaling line circuits, and the notification appliance circuits.

The initiating device circuits connect the initiating devices to the fire alarm system control unit. Fire alarm initiating devices may include manual fire alarm boxes, heat detectors, smoke detectors, flame detectors, water flow alarm initiating devices, or extinguishing system-initiating devices. Supervisory initiating devices may include those for sprinkler system valve supervisory devices, air pressure supervisory devices, fire pump supervisory devices, water level or temperature supervisory devices, or building temperature supervisory devices, to name a few.

Signaling line circuits may include connections to digitally addressable fire alarm or supervisory initiating devices or connections between a protected premises fire alarm system control units and a proprietary supervising station. And finally, notification appliance circuits connect audible and visible notification appliances to the fire alarm system control unit.

For each of these types of circuits, NFPA 72 designates performance by both class and style. Class A circuits will be able to transmit a signal even with a single open fault or a single ground fault on the circuit, while Class B circuits will be unable to transmit a signal beyond a single open fault or ground fault.

NFPA 72 contains a table for each type of circuit that defines the performance of various circuit styles. Table 3-5 covers initiating device circuits, Table 3-6 covers signaling line circuits, and Table 3-7 covers notification appliance circuits.

To meet the requirements of Paragraph 3-4.3.2 of the code, the specifications for a fire alarm system should determine the appropriate circuit class and style based on a variety of factors, including the length of the circuit conductors; the total building area covered by, and the quantity of, initiating devices and notification appliances connected to a single circuit; and the effect of a fault in the fire alarm system on the objectives stated in Section 3-2. The

Wiring Fire Alarms for RELIABILITY

nature of the hazard in the protected premises, the functional requirements of the system necessary to provide the level of protection required for the system, and the size and nature of the population of the protected premises must also be taken into account.

DETERMINE INSTALLATION

Paragraph 1-5.5.4 of NFPA 72 provides the baseline installation requirement, and its related Appendix item A-1-5.5.4 provides additional clarification. According to Paragraph 1-5.5.4, "the installation of all wiring, cable, and equipment shall be in accordance with the NEC, and specifically with Articles 760, 770, and 800, where applicable. Optical fibre cables shall be protected against mechanical injury in accordance with Article 760."

Appendix item A-1-5.5.4 states that "the installation of all fire alarm system wiring should take into account the fire alarm system manufacturer's published installation instructions and the limitations of the applicable product listings or approvals."

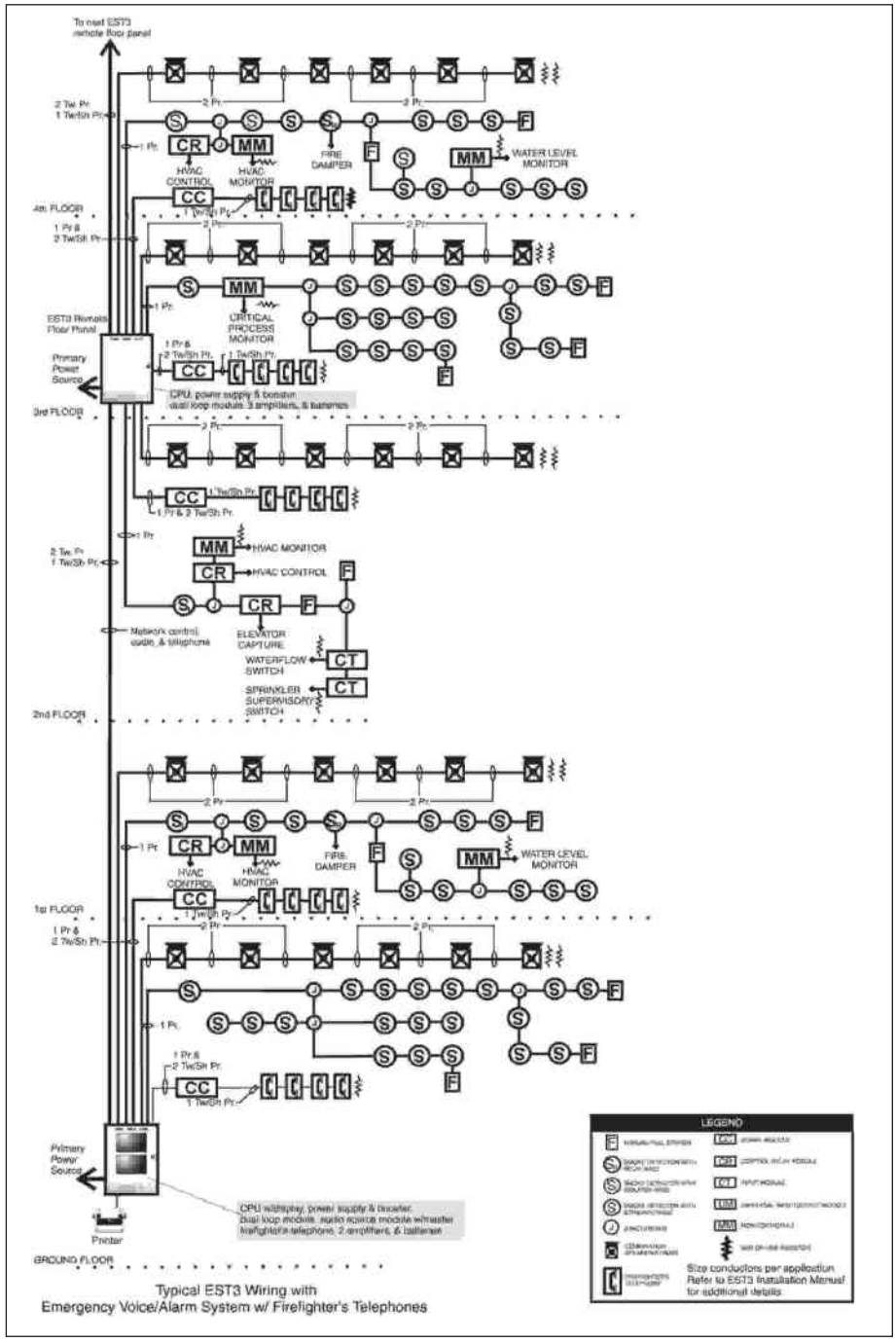
In addition, Paragraph 3-4.2.2.2 provides requirements for the installation of Class A circuits. With some exceptions, it requires the installer to route the outgoing and return conductors separately.

Paragraph 3-8.4.1.1 offers requirements for the survivability of wiring used for notification appliance circuits in fire alarm systems that provide partial selective evacuation or relocation of occupants to areas of refuge in the building during a fire emergency.

Paragraph 3-8.4.1.3.3.3 contains some specific requirements for a fire command center used in conjunction with an emergency voice alarm/communication system, stating that the specifications for a fire alarm system should prescribe the wiring method. The requirements of Article 760, "Fire Alarm Systems," in the NEC apply to all circuits powered by the fire alarm system control units. Control circuits connected to the fire alarm system control unit, but powered from some other source, such as an elevator control system, would have to meet the requirements of Article 725, "Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits."

NEC, ARTICLE 760, PART A

Part A of Article 760 provides general wiring requirements and gives some key definitions for fire alarm circuit and fire alarm circuit integrity (CI) cable, as well as nonpower-limited fire alarm circuit (NPLFA) and power-limited fire alarm circuit (PLFA).



Typical EST3 Wiring with Emergency Voice/Alarm System w/ Firefighter's Telephones

Diagram courtesy of Edwards International.

Section 760-3 also provides a reference to other NEC articles that specifically apply to the installation of fire alarm circuits, including installation practices relating to the spread of fire; ducts, plenums and other air-handling spaces; hazardous locations; corrosive, damp, or wet locations; building control circuits; and optical fiber cables.

Part A of Section 760-7 provides requirements for installing fire alarm circuits that must extend beyond one building and run outdoors. Such extensions of nonpower-limited fire alarm circuits must meet the requirements of Article 225, while such extensions of power-limited fire alarm circuits must meet the requirements of Article 800, Parts B, C, and D, or the requirements of Article 225.

Section 760-8 covers the requirements for the mechanical execution or work. Wiring must be installed in a neat and workmanlike manner. Cables must be supported by the building structure in such a way that normal building use won't damage the cable.

Section 760-10 requires that fire alarm circuits be identified at terminals and junctions to help prevent unintentional interference with these circuits during electrical maintenance.

Section 760-15 offers two choices of fire alarm circuit types: nonpower-limited and power-limited. Unless a fire alarm circuit is designated as "power-limited," it defaults to the designation "nonpower-limited."

Fire alarm system control unit manufacturers use information contained in Tables 12(a) and 12(b) of Chapter 9 of the NEC to determine whether the design of the power supply for a particular circuit will allow that circuit to be designated as "power-limited." This means that the design professional writing the specifications for the fire alarm system must choose the wiring method based on the circuit designations of the specific fire alarm system control

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unit. Or, the design professional may choose to require that all circuits use nonpower-limited wiring methods.

NEC, ARTICLE 760, PART B

The principal differences between nonpower-limited fire alarm circuits and power-limited fire alarm circuits are the types of wiring methods that may be used with them and their requirements for intermixing with other types of circuits.

Part B of Article 760 covers the requirements for nonpower-limited fire alarm circuits. Section 760-25 requires that nonpower-limited fire alarm circuits use either the wiring methods found in Chapter 3 (Article 300) or listed multi-conductor nonpower-limited fire alarm cable. For most commercial or industrial installations, Chapter 3 wiring methods will require individual circuit conductors in raceway, and the installation methods described in Article 300 would apply.

Section 760-26 only allows nonpower-limited fire alarm circuits to be located with other circuits in the same cable, enclosure, or raceway. Nonpower-limited fire alarm circuits may be with Class 1 remote control circuits, but they may only be located with power supply circuits if

Picture courtesy of Notifier Ltd.

they're connected to the same equipment.

Section 760-27(a) specifies the use of solid or stranded copper conductors of size 18 AWG or larger. If 18 AWG or 16 AWG conductors are used, the insulation on the conductors will be limited to the specific types in 760-27(b).

Section 760-28 limits the number of conductors and provides factors for conductors installed in cable trays and raceways, while Section 760-30 permits the use of listed multi-conductor nonpower-limited fire alarm cables. Cables listed for installation in other spaces used for environmental air receive the designation "NPLFP." Cables listed for installation in a vertical run in a shaft or from floor to floor are designated "NPLFR," and cables listed for general installation are designated "NPLF."

Section 760-30(a) allows these listed cables to be installed either on the ceiling or sidewalls in a raceway or exposed to be fished in concealed spaces. Cable splices or terminations must be made in listed fittings, boxes, enclosures, fire alarm devices, or utilization equipment. Where they are exposed, they must be installed in such a way as to receive maximum protection against mechanical damage from the building construction. Cables within 7 feet (2 meters) of the floor must be securely fashioned in an approved manner at intervals of not more than 18 inches (46 centimeters).

Section 760-30(b) requires that cables be installed in such metal raceway or rigid nonmetallic conduit where they pass through a floor or anywhere through a wall from the floor to a height of 7 feet (2 meters) unless adequate protection can be provided by building construction or by a solid guard.

Section 760-30(c) requires the use of a rigid metal conduit, a rigid nonmetallic conduit, an intermediate metal conduit, or electrical metallic tubing where such cables are installed in hoistways. An exception permits methods used for elevators as specified in Section 620-21.

A nonpower-limited fire alarm cable may be marked for circuit integrity if it passes appropriate tests. Such cables may then be used to meet the requirements of NFPA 72, Paragraphs 3-4.2.2.2, Exception (b), and 3-8.4.1.1.4 (1).

NFPA 70-1999, ARTICLE 760, PART C

Part C of Article 760 covers the requirements for power-limited fire alarm circuits.

Section 760-42 requires that all power-limited circuits be durably marked in a place that is plainly visible, so manufacturers usually mark the terminals on the fire alarm system control unit or the accompanying wiring diagram. Circuits that don't have such a marking are considered nonpower-limited.

Section 760-52 specifies the use of solid or stranded copper conductors, while Section 760-52(a) permits power-limited fire alarm circuits to use nonpower-limited fire alarm circuit wiring methods or listed multi-conductor power-limited fire alarm cables. If a power-limited circuit is reclassified and installed as a nonpower-limited circuit, Section 760-52(a), Exception No. 3, requires that the power-limited marking be removed. Sections 760-52(b)(1) and 760-52(b)(2) go on to mirror the requirements of Sections 760-30(a) and 760-30(b) for nonpower-limited fire alarm circuits.

Like Section 760-30(c) above, Section 760-52(b)(3) requires the use of a rigid metal conduit, a rigid nonmetallic conduit, an intermediate metal conduit, or electrical metallic tubing where such cables are installed in hoistways. Again, there's an exception for elevators, as specified in Section 620-21. For power-limited fire alarm circuits, however, there's another exception, which permits other wiring methods and materials installed in accordance with the requirements of Section 760-3 to extend or replace these conductors and cables.

The location of power-limited fire alarm circuits with other circuits in the same cable, enclosure, or raceway is limited by Section 760-54(a). Power-limited fire alarm circuits may not be located with electric light circuits, power circuits, Class 1 remote control circuits, nonpower-limited fire alarm circuits, or medium-power network-powered broadband communications circuits, although exceptions permit the use of a barrier to separate these types of circuits. Where different types of circuits must connect to the same equipment, physical separation must be maintained, or the power-limited fire alarm circuit conductors must be equipped with nonconductive sleeving.

Section 760-54(b) allows power-limited fire alarm cables to be installed with Class 3 circuits and with low-power network-powered broadband communications cables. Power-limited fire alarm cables may also be located with Class 2 circuits if the Class 2 circuit has an insulation at least equal to the insulation on the power-limited fire alarm circuit.

Section 760-54(c) forbids power-limited fire alarm circuit conductors to be strapped, taped, or attached by any means to the exterior of any conduit or other raceway as a means of support.

Section 760-61 specifies the use of listed multi-conductor power-limited fire alarm cables. Cables listed for installation in ducts, plenums, and other spaces used for environmental air are designated "FPLP," while those listed for installation in a vertical run in a shaft or from floor to floor are designated "FPLR," and those listed for general installation use are designated "FPL."

Section 760-61(d) permits the substitution of certain listed cables for listed power-limited fire alarm cables, and Section 760-71(g) permits a power-limited fire alarm cable to be marked for circuit integrity if it has passed appropriate tests. Such cables may be used to meet the requirements of NFPA 72, Paragraphs 3-4.2.2.2, Exception (b), and 3-8.4.1.1.4 (1).

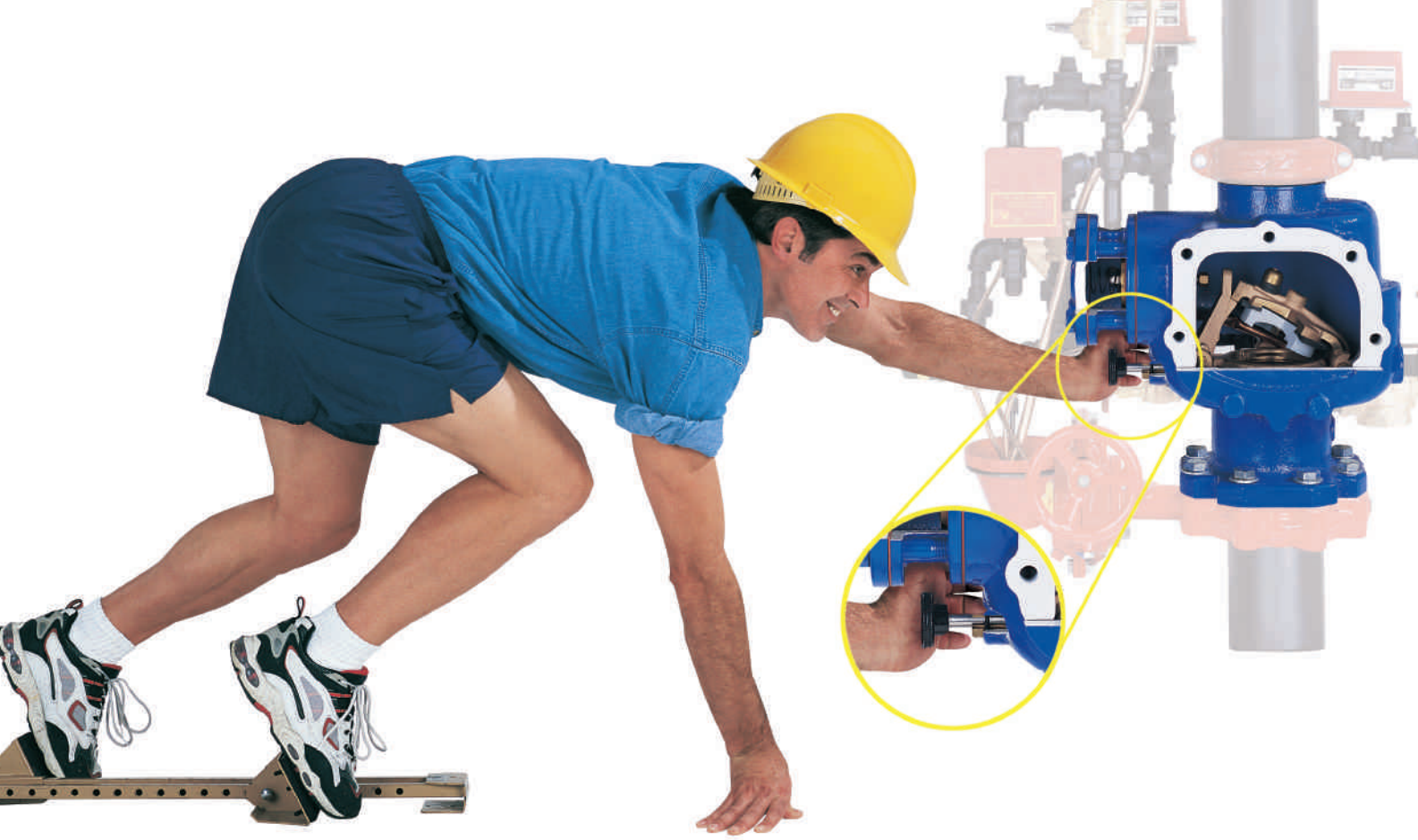
SUMMARY

Fire alarm system wiring can significantly influence the overall reliability of any fire alarm system, so it's incumbent on design professionals to specify the appropriate wiring methods carefully. The requirements of both the NEC and NFPA 72 provide specific guidance that can help the system designer, installer, authority having jurisdiction, and user make certain that the fire alarm system's wiring will allow it to operate properly when a fire occurs.

Dean K. Wilson, a licensed professional fire protection engineer and certified fire protection specialist with an office in Windsor, Conn., is a senior engineer with Hughes Associates, Inc. An NFPA member, he is member emeritus of the Technical Correlating Committee of the National Fire Alarm Code and past chair of Code Making Panel 16 of the National Electrical Code.

Consumers may agonize over their choice of every other fire alarm system component, but very few shop carefully for the wiring that will connect those components.

The 1999 edition of NFPA 70, National Electrical Code®, contains requirements for properly wiring a fire alarm system.



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DELUGE SPRINKLER SYSTEMS

By: Mr. David W. Clark, P.E.
Rolf Jensen & Associates, Inc.

Thanks in part to television and the movies, most of us have seen a deluge sprinkler system in operation. Weather for dramatic or comedic effect, a deluge sprinkler system fits the bill when the action calls for torrents of water splashing down on the actors and set. Unlike a wet type sprinkler system, which would only have a couple of sprinklers flowing water, a deluge sprinkler system has water flowing from every sprinkler. Why settle for reality and just a few operating sprinklers when a monsoon can be conjured up?

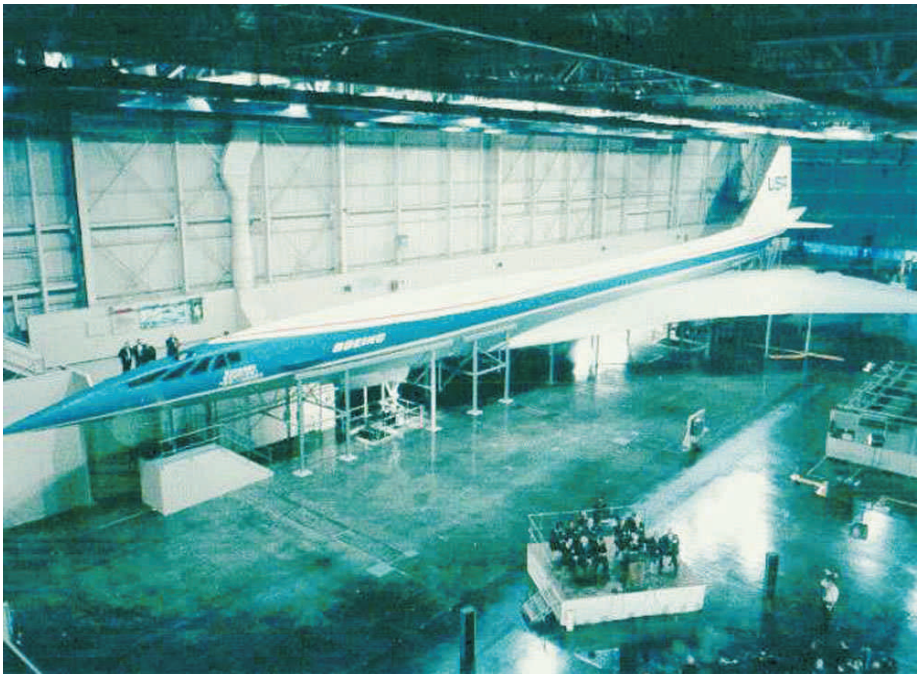
The reality is that some fire hazards require special protection. The basic function of a sprinkler system is to deliver water to a fire by sprinklers connected to a pipe network. Common combustibles and most fire hazards can be protected with a wet type automatic sprinkler system and four or fewer sprinklers will control most fires. A wet type sprinkler system has water in a pipe network and normally closed, heat actuated sprinklers along the system piping. When a fire creates a plume of smoke and hot gas and the increased temperature causes a sprinkler to actuate, water flows from the open actuated sprinkler. Other types of sprinkler systems are used where there is a concern about having water filled pipe in a space, freezing may occur, a protective water curtain is desired, or a high challenge fire can be expected. These other types of sprinkler systems include a dry pipe system, preaction system and deluge system.

A dry pipe system is used where the system is located in an area subject to freezing, such as refrigerated spaces, unheated buildings, and other outdoor installations. A dry pipe sprinkler system has no water in the pipe network, as the water is held back from the pipe network by a dry pipe valve. The pipe network contains air or nitrogen under pressure, which holds the valve in the closed position. When a sprinkler actuates, the air vents out of the actuated sprinkler allowing the dry pipe valve to open. With the dry pipe valve open, water floods the piping and flows out of the open sprinkler, or open sprinklers if more than one has actuated. The dry pipe valve is located in a heated space or enclosure to protect the water below the dry pipe valve from freezing. The air in the pipe network, maintained by a compressor, allows the integrity of the piping to be supervised via a low air pressure alarm.

Annual Trip Test of Deluge Sprinkler System

Preaction sprinkler systems are typically provided where there is a concern about having water a water filled pipe above equipment or a commodity, such as an electronic equipment or computer room. The preaction sprinkler system requires a detection system to actuate prior to releasing water into the pipe network. Similar to a dry pipe system, a preaction sprinkler system has no water in the pipe network and standard sprinklers along the piping. The sprinkler-protected space is provided with a detection system, such as smoke detectors or heat detectors. Actuation of the detection system opens the preaction valve allowing the sprinkler pipe to fill with water. The water filled pipe and closed sprinkler heads essentially function as a wet sprinkler system at this point. The heat from the fire may eventually actuate one or more sprinklers, allowing them to open and flow water from the system.

A deluge sprinkler system is used when it is desired to have lots of water delivered to a hazard. An operating deluge system controls a fire or otherwise



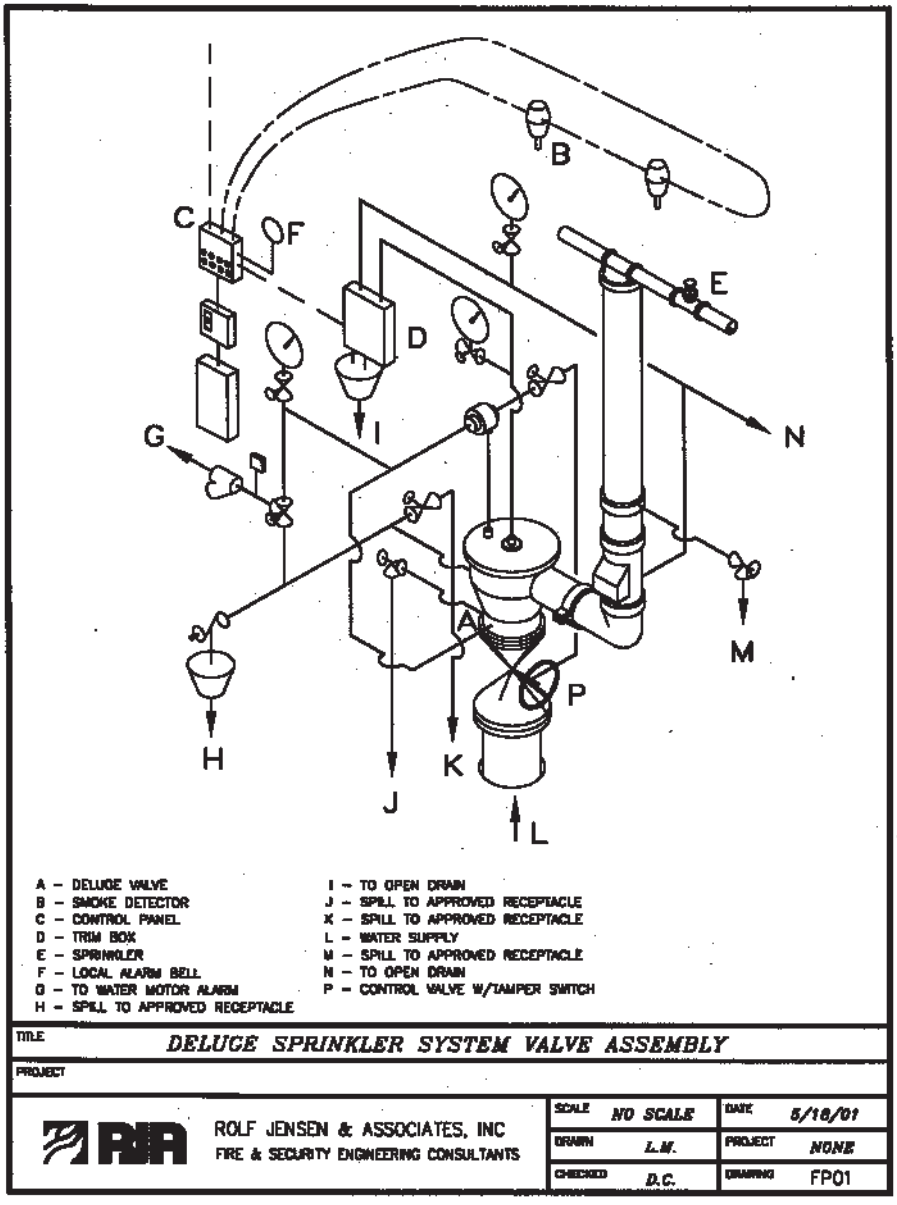
Aircraft Hangar – Deluge Sprinkler System Application

protects from the effects of a fire by flooding an area with a deluge rain. Where a severe fuel hazard, rapidly growing or fast spreading fire can be expected, a deluge automatic sprinkler system offers the best protection. Applications include aircraft hangars; power generating facilities, and petroleum processing and storage facilities where a pooling flammable liquid fire might be expected. The deluge system may have foam concentrate added to the water to provide additional fire suppression and control. Similar to the dry pipe system and preaction system, a deluge sprinkler system has no water in the pipe network. Also similar to the preaction system, the deluge valve is opened by the actuation of a detection system provided in the sprinkler-protected space. Unlike the sprinkler systems discussed above however, the sprinklers on a deluge system are open and have no heat actuated operating element. When the detection system actuates, the valve is opened and the pipe network floods with water and out of all the sprinklers.

The design and installation of deluge sprinkler systems is covered by National Fire Protection Association (NFPA) codes and standards that include:

- NFPA 11, Low Expansion Foam
- NFPA 13, Installation of Sprinkler Systems
- NFPA 15, Water Spray Fixed Systems
- NFPA 16, Deluge Foam-Water Sprinkler Systems and Foam-Water Spray Systems
- NFPA 409, Aircraft Hangars

Typical applications of deluge sprinkler systems using low expansion foam concentrate per NFPA 11 are fuel storage tanks, tank farms, dike protection, and related processing rooms. NFPA 13, which provides design and installation requirements for all sprinkler systems also contains deluge sprinkler system applications that include water curtains as provided for the protection of stage prosceniums, marine terminals, piers and wharves, organic peroxide formulations, cable trays and tunnels, turbine buildings, hyperbaric chambers, water-cooling towers, and spray booths. Deluge water spray fixed systems are used for oil filled transformers, fuel storage tanks, liquid petroleum gas tanks and other cooling applications as described in NFPA 15. The deluge foam system described in NFPA 16 is used in truck loading bay applications, and NFPA 409 describes the use of deluge



Design Detail – Electronic Release Deluge Sprinkler System Valve Assembly

DELUGE SPRINKLER SYSTEMS

sprinkler systems in aircraft hangars. In addition to the applicable NFPA codes and standards, the design and installation may also be subject to insurance carrier requirements or other requirements of the authorities having jurisdiction.

A deluge sprinkler system is similar to traditional wet type sprinkler systems, but significantly different for its open sprinklers and valve operation via a detection system. With all of the sprinklers on the system open, the water demand for a deluge system is larger than a comparable wet system, which is based on only a portion of the system operating. As a result, a deluge sprinkler system often requires a supplemental water supply such as a water storage tank and/or a fire pump. The water demand of a deluge system is to be hydraulically calculated as required by NFPA 13. Other deluge system design requirements are for a water flow alarm independent of the detection system alarm, and a manual means for operation.

In addition to a manual means of activation, deluge systems are typically provided with a detection system to operate the valve. Methods of activating a deluge system include pneumatic and hydraulic detection systems, smoke detectors, heat detectors, or flame detectors. An automatic wet type sprinkler system can even be installed in the area protected by the deluge sprinkler system as the detection system, provided it is not a space subject to freezing. In any event, the detection devices should be listed for releasing device service, such as the various devices found in the Underwriters Laboratories Fire Protection Equipment Directory. The detection devices should be selected to be appropriate for the fire hazard, and the characteristics and environmental conditions of the protected space. The mode of fire detection should also be compatible with the type of deluge valve to be used. Where an electrical detection system is employed to operate an electronically released deluge valve, the detection circuit should be connected to a listed releasing panel to form a complete releasing system.

The deluge valve releasing system is normally one of three primary types, either an electronic release deluge system, a pneumatic release deluge system, or a hydraulic release deluge system. The electronic release deluge sprinkler system valve assembly is the most common type encountered. The electrically operated deluge valve is intended to be used with a complete electric system. It offers flexibility in that a variety of detection devices are available and the detection system can be configured in many ways. The electronic detection system operates like a traditional building fire alarm system, except it actuates the deluge valve through a releasing control panel.

Pneumatically operated deluge valves are provided with a pneumatically operated rate-of-rise heat actuated detectors, fixed temperature detectors, manual releasing devices, or combinations thereof. The pneumatic release system, also know as a dry pilot line system, has the detectors connected to small copper tubing. Pressurized air or nitrogen is maintained on the pneumatic detector and copper tubing circuit for supervisory purposes. When a fire causes a detector to operate and change the air pressure in the dry pilot line and valve actuator, the pneumatic valve opens.

The hydraulically operated deluge valve release system, sometimes referred to as wet pilot line system, is provided with detectors similar to the pneumatically operated valve. The hydraulic system also operates similar to the pneumatic system, except that the detection circuit contains water under pressure instead of air under pressure.

As with any sprinkler system, NFPA 13 details the acceptance testing requirements for commissioning a deluge sprinkler system. In order to hydrostatically test the sprinkler system piping, closed sprinklers need to be installed in lieu of the open sprinklers. After the hydrostatic test is complete, the closed sprinklers need to be swapped out for open sprinklers, or the heat actuated element of the sprinklers needs to be removed thus making them open sprinklers. Additionally, testing of the valve is to be by manually and automatic actuation.

Inspection, testing and maintenance of deluge sprinkler systems includes activities typical of sprinkler systems along with requirements specific to deluge systems, as detailed in NFPA 25, *Standard for the Inspection, testing and Maintenance of Water-Based Fire Protection Systems*. The water pressure gauge on the supply side of the deluge valve is to be inspected weekly to verify the normal water supply pressure is being maintained. The deluge valve is to be inspected monthly for physical damage or leaking, and that the trim valves are in the correct position. The water flow alarm is to be tested via the bypass connection on a quarterly basis. Annually, deluge valves are to be trip tested at full flow. Where the nature of the protected property is such that water cannot be discharged for test purposes, the trip test is to be conducted in a manner that does not necessitate discharge in to the protected area. Similarly, where the nature of the protected property is such that water cannot be discharged unless protected equipment is shut down, a full flow system test is to be conducted at scheduled equipment shutdown while not exceeding a test frequency of 3 years. The interior of the deluge valve shall be inspected and cleaned at the annual trip test, except that valves that can be reset without opening the valve may be inspected every 5 years. Where the deluge sprinkler piping is subject to freezing, any low points in the piping are to be drained after each operation.

As with any sprinkler system, reliability and performance are based on many factors. Selecting the proper type of sprinkler protection, providing a design to meet code requirements, ensuring the installation remains compliant, and caring for the system during its operational life are all vital ingredients to establishing a sprinkler system as ready to meet any fire challenges that may occur. As such, deluge sprinkler systems offer a proven method of protection when conditions of occupancy or special hazards might require the quick application of large quantities of water. Unlike television and movies where a deluge system is used to add action, the real life use of a deluge system is to keep a spectacular fire off the evening newscast.

Mr. David W. Clark, P.E. is a Consulting Engineer with the Atlanta office of Rolf Jensen & Associates, Inc. He has worked on a variety of facilities and occupancies, including high-rise office buildings, airport traffic control towers, retail facilities, campuses and mixed occupancy buildings. Mr. Clark holds a degree in Fire Protection Engineering from the University of Maryland. To learn more about RJA visit their website at www.rjagroup.com

Harmonised Standards for Fire Detection (EN 54)

By Anders Strom

A SNAPSHOT OF HOW THE NEW HARMONISED STANDARD FOR FIRE DETECTION IN EUROPE, EN 54, WILL IMPACT THE MARKET AROUND THE WORLD

Picture courtesy of Notifier Ltd.

The most important regulations governing the fire detection industry are the local codes and standards concerning the functionality and safety of equipment. Although each country has its own local codes and standards most countries are now gravitating towards one of two main product standards, UL or EN 54, with minor local variation. While UL is a familiar concept in North America, EN 54 – the new unifying pan-European standard for fire detection products is a new concept still in its infancy, but promising to have considerable impact on the rest of the world.

EN 54 – THE STANDARD

One of the driving concepts behind the creation of the European Community is the harmonisation of standards aimed at removing trade barriers between member states. The process of unifying all the national European standards for fire detection has taken close to 20 years and proved very difficult. It was finally achieved by a compromise. The European countries decided that, in addition to the unified standard, EN 54, there should be 12 "options" that could be applied on a country-by-country basis. Thus, each individual country could keep some of its favourite requirements.

EN 54, similar to UL, is comprised of different sections. EN 54 Part 2 deals with control and indicating equipment, EN 54 Part 4 deals with power supplies and EN 54 Parts 5 & 7 deals with thermal and smoke detection devices respectively. Currently only EN 54 Parts 2 & 4 have been ratified and published. EN 54 Parts 5 & 7 are still in draft mode but there is an early un-ratified version that has been published in the UK among other countries currently test to this standard.

Once a product line is EN 54 compliant, it can technically be sold in any European country. However, in most cases, panel software, instruction manuals and other material needs to be localised.

THE IMPLEMENTATION OF EN 54

European countries are currently in the process of replacing their domestic standards with EN 54. Some countries have already done so while others are more cautious and will give approvals based on compliance with EN 54, but may still have additional country specific requirements. During the implementation period (up to 5 years after the standard has been ratified and published) countries are allowed to maintain specific national requirements in addition to EN 54.

TESTING –V- LISTING

To obtain listing in a European country, one must first test to that countries standard, whatever combination of EN 54 and national standard that may be. A test report is produced and submitted to the accreditation body in the particular, which issues certification (lists the products in that country). According to EN 54, the original test report, provided the compliance testing has been performed by a notified body shall be accepted in any European Union member country and serve as the basis for certification in that country. At this moment in time this scheme has not yet been fully implemented, but most accredited test labs in Europe have reciprocal agreements to accept some or all of each other's test results although some labs have stronger ties with each other. In some countries, for example Germany and the UK, the accreditation body and the test lab are one and the same organisation (Vds and LPC). In other countries, for example Austria and Denmark, the accreditation does not operate test facilities and will accept a test result from most labs.

THE SIGNIFICANCE OF EN 54

As with all heavily regulated industries, the fire detection industry does not change quickly. A change necessitates the approval of all the different entities that approve or disapprove new codes and standards and this process can sometimes take years. In the case of EN 54 it has taken over twenty years. To some, the current situation may seem very confusing but one must remember that the idea of a unified European standard is in its implementation phase and when the smoke clears there will be ONE UNIFIED

BASE STANDARD in Europe. For manufacturers this means that one product design will meet the requirements in all EU countries and for the end-user, this should translate into lower cost and greater availability of different brands.

However, EN 54 will not only effect the European market, but impact many other areas as well. If other European community standards such as ISO 9000, is any indication, EN 54 will have a profound effect on the world market for fire detection. Although the picture is still a bit fuzzy, it is possibly to sneak a peak at what the world will look like in 5 years from now.

As EN 54 takes hold in Europe it will, at the same time, grow in importance around the world. This development will take place for two reasons.

1 Universities that provide specialised programmes for fire protection engineers are far and few between. The largest concentrations of such institutions are in Europe and the US. European and US fire protection programmes probably provide in access of 90% of the worlds fire protection engineers and attract student from every country in the world. Many of these individuals move back to their native countries after they graduate. Some find work with engineering firms; others may take positions with the regulatory authorities. In both cases, they will favour that in which they have been trained, which in the case of European graduates will be EN 54. As time moves on, we will have an increasing cadre of EN 54 trained graduates around the world. EN 54 will have an effect on pre-EN 54 graduates as well. Any self-respecting engineer keeps in touch with his Alma mate and keeps up-to-date with developments in the industry. As a result, older graduates from European institutions will be well versed in EN 54 and consider it the "latest development".

2 The second way EN 54 will influence the international fire detection community has to do with how countries develop their codes and standards. Most countries, outside of Europe and the US, lack the codes and standards generating bodies present in these markets. It is often a government body that mandates what has to be installed, where it has to be installed and how it must function. Most of these government bodies will pick and choose between various international standards, putting together a national standard that contains the best elements from a variety of input sources. EN 54 is a good standard and will influence the direction of countries in Asia, Eastern Europe and the Middle East.

Picture courtesy of Notifier Ltd.

EN 54 is probably the most significant development the global fire detection industry has seen in the past decade and it is promising to have an impact we have only begun to grasp. Most manufacturers have already begun to introduce products that comply and others are still busy in the design stage. Most end-users are also aware of EN 54 and are wisely insisting that their product choices comply with future codes and standards.

Fire-rated non-loadbearing partitions

By RON SMITH,
Technical Consultant
for ASEP

LIGHTWEIGHT fire-rated non-loadbearing partitions are used in all types of buildings and the actual specified performance criteria and the required appearance will determine the overall form of construction. To some extent, all partitions assist to contain the effects of fire but, when correctly specified and installed, a partition will contribute substantially to the safety of the building occupants. Unfortunately, many "fire-rated" partitions are incorrectly specified and are incorrectly installed. Hopefully, the following will assist in establishing some of the important factors related to the testing of fire-rated partitions.

Perhaps it would be useful to define a partition. British Standards defines a partition as an "internal, dividing, non-loadbearing, vertical construction", whereas European Standards (CEN) define it as a "non-loadbearing wall". Just to confuse matters, The EOTA European Technical Approval Guideline for partitions is entitled "Internal partition kits for use as non-loadbearing walls". What happened to European harmonisation?

THE FUNCTION OF A FIRE-RATED PARTITION

The requirements to determine the resistance to fire and the reaction to fire performance of a fire-rated partition are stated in the relevant building regulations, which in England is Approved Document B. A fire-rated partition is thus a partition for which the resistance to fire performance has been determined by either a British Standard fire test or a European fire test. In the UK there is also a requirement for a reaction to fire performance to the exposed surfaces of the partition and the appropriate performance is also derived from fire tests.

In a new building a partition may be required to contain fire within a space, or to provide a means of escape into which a fire will not readily penetrate. The first of these two concepts is known as compartmentation, and the second as a protected corridor. When a partition is providing such functions it must comply with the relevant guidance provided in the building regulations.

The usual outbreak of a fire and its growth rate is mainly caused by the ignition of the contents of the building. It should be borne in mind, however, that the surfaces of ceilings, partitions and walls could also significantly contribute to the fire – depending upon their reaction to fire characteristics. Ensuring that the surface materials are difficult to burn will mean if a fire does occur, the contribution to the fire from such surfaces will be limited. A protected corridor will be both resistant to fire and will be faced with good reaction to fire materials in order to enable occupants to readily escape from the building.

RESISTANCE TO FIRE TESTING

In the UK, the fire resistance of non-loadbearing partitions is evaluated in accordance with the following test methods.

BS 476 Part 20, entitled "Method for determination of the fire resistance of elements of construction", which details the general principles for fire testing and

BS 476 Part 22 entitled "Methods for determination of the fire resistance of elements of non-loadbearing elements of construction", which details the procedures for testing partitions.

The fire test measures two specific criteria: **integrity** and **insulation.**

Integrity is the ability of a test specimen of a separating element of building construction, when exposed to fire on one side, to withstand collapse and to prevent the passage of flames and hot gases passing through it, and to prevent flaming on the unexposed side.

Failure of integrity occurs if, during the fire test;

- the specimen collapses
- sustained flaming is observed on the unexposed face
- a cotton pad can be ignited by hot gases emerging from the specimen
- it is possible to penetrate a gap in the specimen with a 25 mm diameter gauge
- it is possible to penetrate a gap in the specimen with a 6mm diameter gauge and for it to be traversed for a distance of 150 mm

Insulation is the ability of a test specimen of a separating element of building construction, when exposed to fire on one side, to restrict the temperature rise of the unexposed side to a maximum average of 140°C above ambient. This requirement for insulation is the one that is very often overlooked during site installation.

Failure of insulation occurs, if during the fire test;

- integrity failure occurs
- the average unexposed face temperature rise, as measured by the thermocouples, is greater than 140°C
- the maximum unexposed face temperature rise, as measured by any of the fixed thermocouples and roving thermocouple is greater than 180°C

In future, with the advent of European fire testing, the new EN standards will be more rigorous and will incorporate some new procedures to satisfy all Member States. The two new principle methods for the testing of partitions to Euro standards are;

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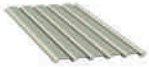
Wall Profiles


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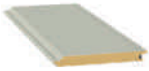
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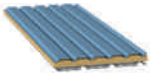
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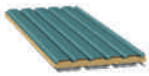
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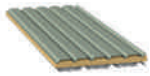
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Fire-rated non-loadbearing partitions

- BS EN 1363-1 "Fire Resistance Tests: Part 1: General requirements", which is similar to BS 476 Part 20, and
- BS EN 1364-1 "Fire Resistance Tests for Non-loadbearing Elements: Part 1: Non-loadbearing walls", which is largely equivalent to BS 476 Part 22 but contains several additional requirements for glazing, separate evaluation of areas of different insulation, field of direct application for extension to height and width, etc

REACTION TO FIRE TESTING

Reaction to fire tests have been used for many years in the UK and appear to be well known. The actual linings (faces) of the partition are required to be classified according to the requirements of the building regulations. A number of British Standard tests are predominantly used to test the lining (facing) material to the studwork supporting construction. These are:

- BS 476 Part 4 "Non-combustibility test for materials"
- BS 476 Part 11 "Method for assessing the heat emission from building materials", which is known as the "limited combustibility" test
- BS 476 Part 7 "Method for the classification of the surface spread of flame of products", which is known as the "spread of flame" test
- BS 476 Part 6 "Method of test for fire propagation for products", which is known as the "fire propagation" test

Building regulations also refer to a "Class 0" requirement, when restricting the reaction to fire performance of partition linings. Class 0 is neither a test nor is defined by British Standards but, in order to achieve Class 0, a lining material must have a Class 1 surface spread of flame and fire propagation indices i not exceeding 6 and I not exceeding 12. Non-combustible materials are also defined as Class 0. Further information relating to Class 0 can be obtained from the Association for Specialist Fire Protection (ASFP), technical guidance note number TGN 005.

In the not too distant future, current reaction to fire tests and classifications will disappear and European classifications will be used for partition linings. The new classifications will be taken from A1, A2, B, C, D. E and F.

It should be noted that the English Building Regulators are, at the moment, amending the current Approved Document B to include the new European classifications for both resistance to fire and reaction to fire. It is anticipated that a "European" supplement to document AD B will be circulated for public comment around early autumn of this year. Several months ago, the Scottish Executive issued, for public comment, proposals for a sixth amendment to the Building Standards (Scotland) Regulations. These proposals included references to the new European fire tests and classifications.

SPECIFYING FIRE-RATED PARTITION

METAL STUDS

As we are all aware, metal expands when exposed to heat and a lined (faced) metal stud frame will undergo various movements in a fire situation. In the initial stages of a fire, one flange will be at a higher temperature than the other and the temperature differential causes the stud frame to bow towards the fire. Eventually, when the exposed face linings have burnt away, the metal temperature will be such that the metal stud has virtually no strength and integrity failure is very likely to occur. The principle in obtaining high fire resistance is to use suitable board linings that protect the metal from the heat for as long as possible. For this reason, a board cover fillet is often fixed to the metal flanges prior to the lining being fitted.

TIMBER STUDS

Timber studs do not expand, but tend to shrink slightly when heated and will then burn. However, because of the limited amount of shrinkage in the timber, there is little movement to the studwork of the partition. This, of course, means the studwork will not readily buckle and will not transfer additional stresses to the lining (facing) boards and fixings. Consequently, in a fire, the lining boards will remain in position longer than they would on a similar metal stud partition. Timber has good thermal properties but different species char at different rates. The actual charring rates are largely a function of density, with the usual rate of depletion being taken as 20 mm in 30 minutes from each exposed face for normal structural softwood. The rate of charring is little affected by the severity of the fire and, for an hour's exposure, the depletion is 40mm for most structural softwoods.

MINERAL WOOL

Mineral wool, with a high melting point, is often used in partitions when long periods of fire integrity and insulation are required. Factors, which affect the additional fire insulation, are;

(i) The type of mineral wool – stone wool has a higher melting point than glasswool
(ii) The density of the wool – generally higher density wool provides longer insulation times

Mineral wool should NOT be added to a standard un-insulated partition without fire test evidence as this could adversely affect the fire performance of the partition.

BRIEF CONCLUSIONS

Partitions can be constructed in a variety of ways and the designers' specification will be based upon the intended use, performance levels and the standards of finish and/or appearance required. Partitions may be formed from various types of sheet materials (linings) supported by timber or metal stud framework, with or without expressed/featured joints. They may be constructed by using composite panels supported by an exposed framework, or prefabricated panels butted together in floor and head tracks, with or without a supporting frame. In such a short article it is not possible to cover all such items.

Further information regarding fire-rated non-loadbearing partitions will be available from the Association for Specialist Fire Protection (Tel: 01252 321322) later this year when they publish a guidance note entitled "Fire-rated Non-loadbearing Partitions". FIRAS have also now introduced courses for the installation of fire-rated partitions.

Control Fire Systems Ltd IS PLEASED TO ANNOUNCE THE DISTRIBUTION OF ARGON FIRE SUPPRESSION SYSTEMS THROUGHOUT NORTH AMERICA

Argon clean agent fire suppression systems are now available from Control Fire Systems Ltd. (CFS) of Niagara Falls, New York and Toronto, Canada.

Argon is an inert gas and is zero ozone depleting (ODP) and has Zero Global Warming potential (GWP), making it 100 percent environmentally friendly. Argon is found in the atmosphere and so is readily available, and easy to refill, unlike blended mixtures. Argon inert gas systems are also Underwriters Laboratories Inc. (UL) and Underwriters Laboratories of Canada (ULC) listed for occupied spaces, rendering them non-toxic to humans. Argon total flood fire suppression systems have also been approved by LPCB of the United Kingdom and VDS of Germany. Although the UL testing of the Argon systems was performed with Notifier releasing panels, any UL listed releasing panel can be used with CFS' Argon suppression systems, when installed according to NFPA 2001.

Argon is heavier than air, and so permeates the hazard area quickly and thoroughly. The fire suppression effect is achieved by the displacement of oxygen in the air. In the majority of cases, the fire will be suppressed when the oxygen level in the room sinks to a volume of 13.8% at a 36.2% Argon concentration level. Where the object being protected requires less oxygen to support combustion, the concentration of Argon must be raised accordingly, as per The Authority Having Jurisdiction. It should be noted that all enclosures equipped with Argon suppression systems should include a pressure damper.

Argon systems are unique in nature in that each cylinder hangs from an individual weighing leakage device, rather than lying flush on the floor. This provides constant supervision of the cylinders that indicate weight losses of as little as 5% of the Argon agent. This is an inexpensive means to monitor, at a glance, each cylinder's Argon leak seal integrity. In fact, the Argon mechanical fire suppression equipment has been used in Europe for decades.

Argon systems are available in 79L cylinders at a pressure of 2900 psi inside the bottles, that is then reduced to 800 psi at the discharge nozzles. Argon systems are ideal for computer rooms and data processing areas; telephone switch gear enclosures; remote cell sites; art galleries; bank vaults and other document storage, as well as a host of other applications.

In addition to the standard configurations available for Argon systems, CFS provides integrated system solutions, such as cabinets and groups of cabinets or containers with the cylinders and the release control installed in one cabinet.

Argon systems are manufactured by Minimax of Germany.

For more information, please contact:
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Fax: +1 416 233 6814 E-mail: info@controlfiresystems.com

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NEW FIRE ALARM CONTROL PANELS OFFER THE BEST OF BOTH WORLDS

A new line of fire alarm control panels from Edwards Systems Technology, Inc. (EST) liberates small and medium-sized buildings from the all-or-nothing approach to system design. QuickStart life safety systems support intelligent circuits, conventional circuits – and a combination of both.

QuickStart lives up to its name in every respect. Its exclusive auto-learn routine, combined with its built-in scanner port ensures a fast, trouble-free installation every time.

New installations benefit from EST's widely acclaimed Signature Series family of intelligent detectors and modules. Now no job is too small for true multisensor technology, environmental compensation, electronic addressing, and the power of intelligent processing that, before QuickStart, was the exclusive domain of big systems.

Retrofit applications enjoy the best of both worlds. QuickStart's support for both intelligent and conventional circuits ideally positions this innovative control panel for upgrading an existing system all at once – or in stages. With Signature Series' unique ability to use existing wiring, expensive communications-grade cable and costly rewiring is not required in most retrofit situations. This means every retrofit can enjoy the benefits of a major system upgrade without the cost or disruption to building activities normally associated with a life safety overhaul.

New or retrofit, QuickStart's application flexibility and ease of operation make it an ideal choice for schools, apartment building, hospitals, office building and retail facilities. Easy to install, simple to set up, and rock-solid when it comes to performance, QuickStart control panels are an installer's dream and a building owner's delight.

For more information, please contact: Edwards International
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FIRETROL, INC.

Firetrol®, Inc. recently unveiled its Mark II Electric Fire Pump Controller. The controller monitors, displays and records fire pump system information. Features include a door mounted user interface, vacuum fluorescent display and available printer and/or 3.5" floppy disk drive.

The controller provides True RMS metering and simultaneous 3-phase display of both voltage and current. Historical data and pressure readings can be stored and retrieved many ways. The available 1.44 MB floppy drive can store up to a years worth of data on a single disk, the printer can provide hard copy print out with approximately 72 days worth of data on a single roll and the Mark II records a history of the last 2000 events which can be viewed on the 2 line display. The controller is available in any starting method, is UL Listed and FM Approved and CE Certification is pending. Contact Firetrol or your Local Representative for complete information on our innovative new design.

For more information, please contact: Firetrol, Inc.
Fax: +1 919 460 5250 E-mail: sales@firetrol.com

FULLEON'S ROSHNI SETS THE STANDARD

In recent years, the Roshni sounder has become so well established in the international fire detection and alarm and security markets that the name is often used as a generic description for this type of electronic sounder. The truth of the matter, however, is that the Roshni was created and is manufactured exclusively by Cwmbran-based Fulleon.

Available for either mains operation – the Roshni Mains – or as the Roshni LP, the primary application for this wall-mounted sounder is signalling in open areas, corridors and passages. There is a choice of 32 alarm tones that are switch selected at installation, which ensures Roshni's compatibility with the majority of signalling tones used around the world. The sounders operate at up to 111dB(A), plus there is a facility to incorporate a second tone for two-stage alarms. There is an automatically synchronised start when operated on the same circuit, which provides enhanced signal clarity on multi-sounder circuits.

The Roshni is available in either red or white with a choice of three base formats, ensuring its suitability for different wiring and installation techniques, plus there is an anti-tamper version and an intrinsically safe model. The base options include a shallow design for flush wiring that is just 63mm deep overall, and deep and U bases, both of which are ideal for surface wiring and allow 20mm diameter conduit entry. A particularly useful feature is that all of the base designs utilise a versatile bayonet fitting that is unique to Fulleon products. This makes for ease of installation and allows other Fulleon products, such as the Flashni combined sounder and beacon and the Xenon beacons, to be interchanged with the Roshni sounder.

The energy efficient sounder's low profile casing and fully encapsulated electronics ensure a high degree of durability and a long and trouble-free working life. Both the deep and U base versions are IP65 rated. Roshni LP sounders can be used on either 12-volt DC or 24-volt DC systems without modification, while the Roshni Mains is suitable for 110-volt AC and 240-volt AC at 50Hz to 60Hz.

The anti-tamper model is aimed at installations where vandalism is a potential problem, while the intrinsically safe Roshni is specifically for on and offshore applications in the oil, gas and petrochemicals industries. Roshni is approved in the UK by the LPCB [Loss Prevention Council Board] and was the first sounder on the market to be fully compliant to prEN54-3. It has also achieved Vds approval in Germany and UL [Underwriters Laboratories] approval in the USA.

Fulleon is a global business that today employs 180 people at its new, purpose built Design and Manufacturing Centre in South Wales. The ISO9001-accredited company is a major exporter with an environmental priority that is confirmed by its ISO14001 status.

For more information, please contact: Fulleon Limited
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LPG FE-13™ SYSTEM

COMPANY ACTIVITY

Since 1985, LPG has been researching, designing, manufacturing and supplying a wide range of industrial fire extinguishing systems to protect life and property. Among LPG's most important products are the total flooding systems based on gaseous extinguishing agents such as FM-200™, FE-13™, CO_2, ARGON and also WATER MIST systems. The Company currently has ISO 9001 Quality Certification by the German TÜV and ISO 9002 by LPCB of the United Kingdom.

FE-13™ SYSTEM

- Wide safety margin for occupied areas even at high design concentration
- Zero Ozone Depletion Potential
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LPG has developed the hardware for FE-13™ from this experience on high-pressure systems and proven CO_2 technology. As FE-13™ has a vapour pressure at 20°C of 41.82 bar (a) it doesn't require over pressure with additional Nitrogen. The agent is contained in high-pressure seamless steel cylinders and it is discharged through LPG's valve.

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DAMAGES ON ASGARD B PLATFORM IN NORWEGIAN SEA

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The fire ignited when the hot surfaces of the generator set fire to clothing, which had been placed on them. The incident was promptly detected at such an early stage that the Norwegian State Oil Company moved swiftly to put the fire out with no negative consequences to production.

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VESTA S.R.L. the privately owned independent Italian manufacturer of fire protection systems has embarked upon a major expansion programme in order to extend its product range and its global marketing activities.

The highly successful Argonfire® inert gas fire protection range has now been complimented by the introduction of a new 300 bar high pressure system (available from 2002), employing an entirely new high efficiency valve.

The introduction of the new system, together with the use of high capacity storage cylinders will continue Vesta's quest to offer the most economic inert gas systems to the fire industry.

New quieter discharge nozzles have also been developed for use with Argonfire® systems, known as The Silence® nozzle it reduces air turbulence and minimises noise levels during gas discharge. This totally unique and patented product reduces the noise level to between 110 dB and 60 dB.

New valve products have also been developed for use with chemical agents, these latest Vesta innovations will be incorporated into Halocarbon systems are of an entirely new design and are highly efficient in operation.

Vesta have also unveiled its plans for expansion into global markets by the appointment of a number of new distributors.

TYCO GRINNELL SALES & DISTRIBUTION have been appointed to market the Argonfire® systems in Norway, Greece, Turkey and Eastern Europe.

HART TECHNOLOGIES PTE. LTD. will handle the product range in the ASEAN region

ATLAS CONTROL SYSTEMS (PTY) LTD. located in Cape Town will represent Vesta for Argonfire® in South Africa

FIRE FIGHTING ENTERPRISES LTD. based in Stevenage will look after the markets of the UK and EIRE

These new appointments come at critical time in our expansion programme, comments Giancarlo Bianchi, General Manager and will now give an entirely new opportunity of choice to the world-wide fire protection market.

For more information, please contact: Vesta S.r.l.
Fax: +390 2 935 50094 E:Mail vestafire@tiscalinet.it

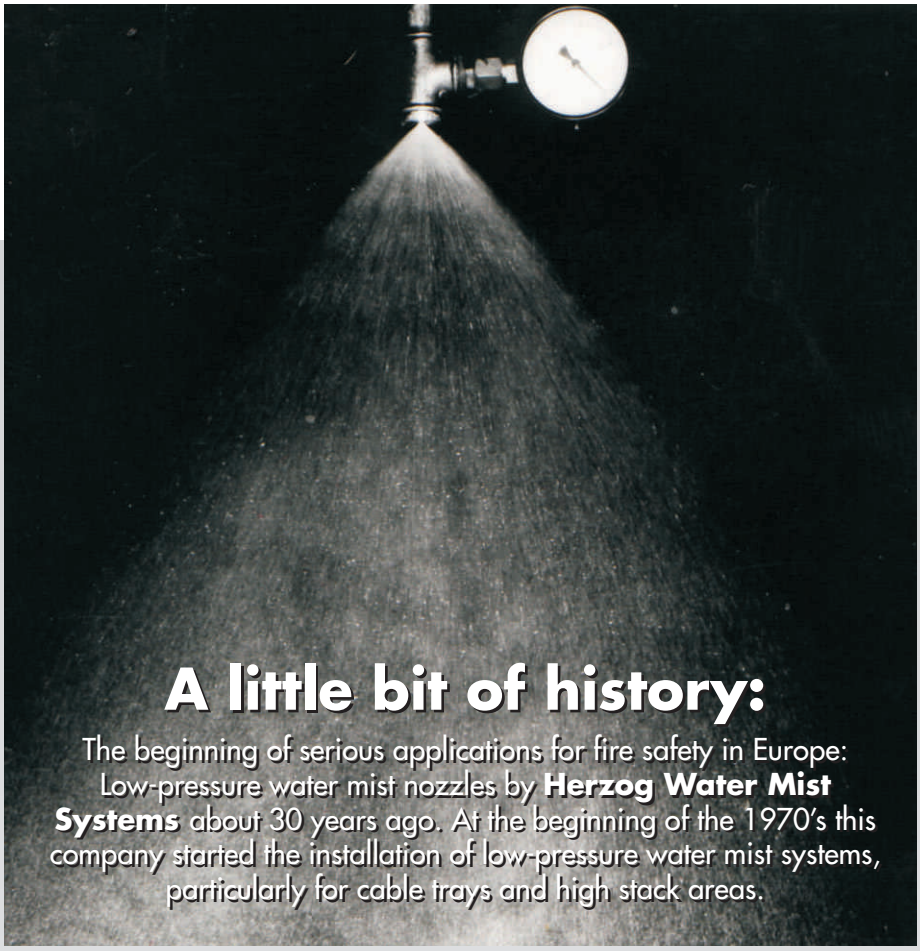
ELIMINATE ACCIDENTAL DAMAGE WITH THE VIKING GRATE NOZZLE

The Grate Nozzle from The Viking Corporation solves the protection problems associated with aircraft hangars.

The Grate Nozzle is an assembly with a stainless steel discharge nozzle and a receiving trench drain grate. The discharge nozzle is level with the floor and discharges foam solution in a 7.6 metre (25 feet) radius. The apex of discharge from the nozzle is 0.5 metres (18 inches); meaning sensitive electrical equipment and expensive machinery are not in the path of the AFFF solution during a false or required system activation.

Located at floor level to eliminate transit time from the ceiling or from remotely located master stream nozzles, the Grate Nozzle has a low pressure requirement of 2.7 Bar – 5 Bar (40 psi – 60 psi) discharging a minimum of 560 lpm – 680 lpm (148 gpm – 181 gpm) and a maximum placement of 15.2 metres (50 feet) by 7.6 metres (25 feet). System design requires that drain trenches be located in the aircraft hangar*at a maximum of 15.2 metres (50 feet), the Grate Nozzles are placed in the drain trenches at a maximum of 7.6 metres (25 feet).

For more information, please contact: Viking Corporation
Fax: +44 (0) 1427 875 996 E-mail: vikinguk@vikingcorp.com



A little bit of history:

The beginning of serious applications for fire safety in Europe: Low-pressure water mist nozzles by **Herzog Water Mist Systems** about 30 years ago. At the beginning of the 1970's this company started the installation of low-pressure water mist systems, particularly for cable trays and high stack areas.

Water Mist Workshop in Colorado, USA

The CCACS (Center for Commercial Applications of Combustion in Space) workshop on water mist fire suppression technology will be held on the campus of the Colorado School of Mines in Golden, Colorado, on October 10 and 11, 2001. This workshop is being organized by the CCACS in cooperation with the U.S. Department of the Navy Office of Safety and Survivability and the International Water Mist Association.

The workshop will bring together product manufacturers, end users, government program managers and university researchers from all around the world to review the current status and future directions of water mist fire suppression technology.

The workshop should be of interest to any company or organization engaged in the production of, or research and development related to, water mist fire suppression systems. Water mist systems are under consideration for a variety of applications, including ships, aircraft and industrial & domestic spaces.

There is no registration fee for the workshop, but registration is required. Please visit the IWMA web page at www.iwma.net ("News and Acts") for further information or visit the web page of the school at http://www.mines.edu/research/ccacs for immediate registration. Interested parties should fill out and submit the response form on the web site of the school. A preliminary program can be downloaded on the IWMA web page also. A more complete agenda will be available at the end of August, along with directions to the campus and a list of local accommodation.

MSC/Circ. 668/728 group continues

The IWMA work group on the revision of the IMO guideline MSC/Circ. 668/728 had last met on the 3rd April 2001, during the IWMA conference week in Vienna, Austria. The minutes of this meeting are currently under revision by the chairman of the last meeting and will be sent to corporate and institutional members after completion. It was decided in the last meeting to pass further work on that subject matter to the IWMA Scientific Council. The committee will work out proposals, which pursue reasonable changes to this particular guideline and will submit these comments to the responsible MSC body.

Manufacturer's Council

With regard to the annual meeting in April, a motion was made and accepted which pursued the establishment of a Manufacturer's Council within the IWMA. It was stressed that the work between Scientific Council and corporations could be more efficient and comments of the manufacturers to suggestions of the Scientific Council could be sought faster that way. Hence, representatives of member companies are invited to state their interest by informing the IWMA office if they would like to become a member of that committee. However, it has to be supplemented that the number of group members must be limited in order to ensure that this body can work effectively.

First Educational Seminar

A two-day seminar "Fire safety with water mist – effective and environmentally friendly technology" will take place on October 18 and 19 in Germany and will be held in the IWMA office.

Members and experts in this field will, in a number of presentations, explain the basic theoretical and functional characteristics of water mist and the wide range of possible applications as well as the current situation concerning codes and standards.

Furthermore, the extinguishing qualities of water mist will be shown in real 1:1 fire tests in order to illustrate the mode of operation in reality to the participants of the seminar.

The seminar is especially designed for architects, consultants and end users who are not so familiar with water mist technology. Similar seminars will be offered soon in other countries also.

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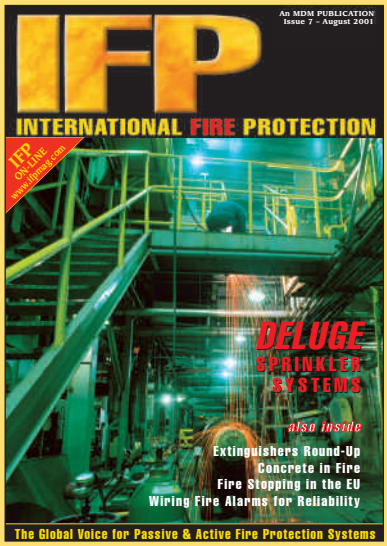

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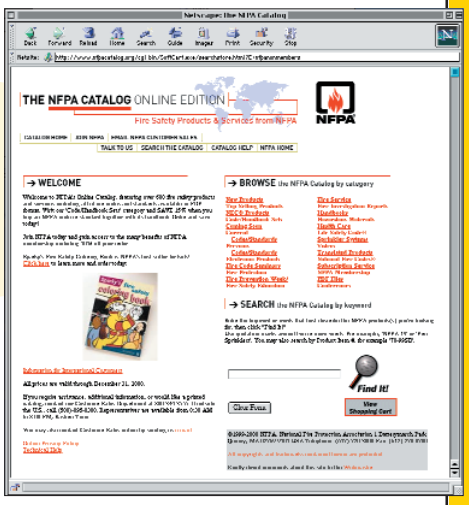

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Issue 8 – November 2001

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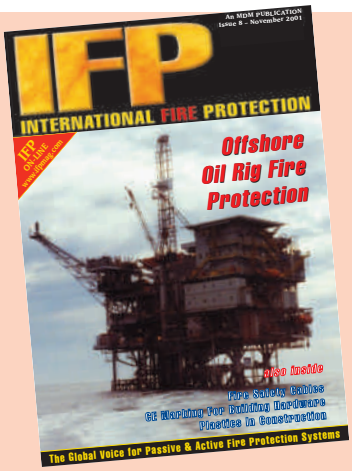

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COMMENT . . .

HERE WE ARE AT Issue 8, the November 2001 edition of **IFP**. All our staff at **MDM Publishing Ltd** would like to express our extreme sorrow and sadness at the events, which took place in the USA on September 11th. An event that none of us will forget and one we pray we will never have to witness again. Our thoughts and prayers are with all the victims, their family and friends at this time.

This issue marks the completion of our second year publishing the magazine. A magazine that we're sure you will agree, has developed and grown since the first issue was published back in February 2000. We still aim to improve every issue, and would like to encourage your comments, praises and criticisms, either by letter or e-mail: ifpmag@globlanet.co.uk.

The main feature article of this issue is **OFFSHORE OIL RIG FIRE PROTECTION** and is authored by Gary Piermattei of RJA. A quality article of great interest to many of you. We also feature, **Fire Safety Cables, Fire Rated Ductwork, Foam Systems For Protecting Storage Tanks, Residential Sprinklers, Standards For Special Hazard Suppression Systems** and much, much more. . . .

NEW LAUNCH

We are also proud to announce our new launch for March 2002. **ASIA PACIFIC FIRE Magazine (APF)** covers all aspects of the fire industry, both fixed and mobile, but has a dedicated circulation in just the Asia Pacific Fire Market. For more information on advertising or subscribing, please logon to our website www.apfmag.com or e-mail Mark Seton at: apfmag@globalnet.co.uk.

We hope you enjoy this issue and although it may seem a little early, we would like to wish you a **Happy Christmas and a Prosperous New Year.**

Until next time . . .
Kind regards

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DET-TRONICS

OFFSHORE OIL RIG FIRE PROTECTION

BY GARY PIERMATTEI, P.E.

Pic: Rolf Jensen & Associates Inc.

Pushing The Limits

DEMAND FOR NEW RESERVES is increasing and oil exploration has been pushing the limits, finding oil in even deeper water every year. Protecting offshore oil rigs from fire requires an equally progressive development of systems to meet the challenge. From the onset, the offshore oil industry expanded on existing marine fire protection technology to meet its needs. This article looks at offshore oil platforms and mobile offshore drilling units (referred to generically as "oil rigs") and the many different fire protection systems used in their protection. These systems must endure a hostile environment, be easy to maintain, address rapidly developing fires with high heat release rates, have a high degree of reliability and meet the approval of a number of regulatory authorities. To meet this challenge, new products and designs have been used to push the limits of performance of some standard fire protection systems. Listed below is a brief description of the systems and how they have been adapted. Some of these improvements may be useful for application in other fields.

GOALS

As with any system design it is vitally important to review the overall goals. Typical land based property and marine based facilities lacking oil related products have different challenges and goals. Most fire protection systems dealing with relatively low heat release hazards have the goal of detecting the fire and controlling or extinguishing the fire prior to the arrival of trained firefighters. Oil rig fire protection offshore deals with a set of conditions similar to refinery-based protection, but with some additional complications: An uncontrolled hydrocarbon release may overwhelm any suppression system, firefighting efforts must be performed by onsite personnel, and evacuating the facility has entirely different risks and consequences than with a land-based operation. The high heat release rate fires make the first reasonable goal to be one of limiting the amount of fuel available to burn. Once the appropriate valves are closed and vessels isolated then the fire suppression systems must protect the valves, vessels and critical structures while the remaining residual fuel is consumed. These different goals make it appropriate to place a different emphasis than is found in many other fire protection applications. Offshore oil rig fire protection by necessity has to place more emphasis on avoiding the fire in the first place and in providing better training to responding personnel.

REGULATIONS

The regulatory process for offshore facilities is very different from that for land based facilities. Many prescriptive features are provided to meet classification society requirements (insurance and finance concerns) and to comply with governmental regulations. There are a number of possible enforcing agencies: the classification society, the

OFFSHORE OIL RIG FIRE PROTECTION

coastal administration of the government to whom the lease belongs, and if it is a vessel, the government under whose flag the vessel is registered.

PASSIVE PROTECTION

Passive fire protection is used on the oil rig to provide protection for essential equipment, maintain structural integrity, and assist with refuge and escape efforts. Bulkhead and deck structures are provided with "fireproofing" to help maintain the adequacy of fire boundaries. While some of this fireproofing involves the use of standard rock wool found on marine structures, there have been a number of intumescent products and specialty coatings that are well suited to the marine oil rig environment. These coatings are typically applied to steel bulkheads and decks, are moisture and oil resistant and can be appropriate for an offshore corrosive environment.

Boundaries that need to be protected include: control rooms, accommodations (living quarters), machinery rooms, process areas, and exit ways. Penetrations of these bulkheads with piping and ventilation ducts need to be properly protected in a manner similar to land based operations. Rated bulkheads are often constructed around the wellhead or other hazardous areas to provide protection for escape routes. Frequently, the helideck and the associated hazards are located above the accommodations requiring a rated separation.

Figure 1. Rolf Jensen & Associates Inc.

FIRE MAINS AND FIRE PUMPS

The fire main system must provide a reliable water supply throughout the facility. For oil processing areas, water is typically used as a means to protect the control equipment, structure, and passive barriers more than as a means of suppressing fires. To this end, it is necessary to have a degree of redundancy built in to the system design. Two independent fire pumps, located in separate spaces with independent sources of power are generally accepted in the industry to meet the requirement of providing a reliable water supply. While fire pumps can be either electric or diesel driven, if both are electric, at least one must be supplied with emergency power. Care should be taken to assure that conductors are routed so that no single event would endanger power for both pumps.

When the fire main is supplied with seawater it is necessary to address corrosion and fouling concerns using special piping materials and treatment systems. Options include upgrading the pump materials to nickel aluminum bronze and the piping to copper nickel or fiberglass. While initially expensive, the increased reliability and reduced operating costs pay off over the long run. Routing of the fire mains is carefully planned to avoid hazardous areas that might be subject to explosion, thereby, putting the main at risk. An example of this is seen in Figure 1 where deluge mains are located below deck girders to afford additional protection from above deck fire hazards.

In an effort to protect the integrity of the fire main, some in the industry prohibit its connection to any other

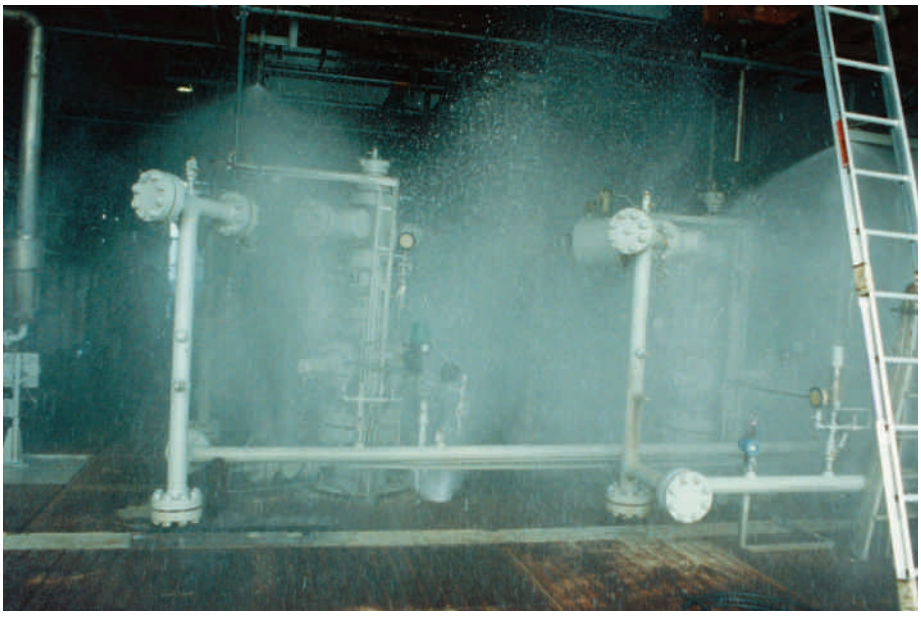

Figure 2. Rolf Jensen & Associates Inc.

OFFSHORE OIL RIG FIRE PROTECTION

system. Others allow the limited use of the fire main for wash down purposes as a means to encourage its maintenance. While there may be different approaches, the goal is the same: a reliable source of water. The fire main is also provided with an international shore connection, a common marine practice. This is a standardized connection through which a vessel can supplement another vessel or platform's water supply. This shore connection is not unlike a fire department connection that we see on land facilities.

DELUGE SYSTEMS

Deluge systems are often used to protect production, off loading, drilling, and wellhead areas. Wellhead area systems often involve overhead spray nozzles along with direct application localized dedicated nozzles for each wellhead. An example of such an arrangement is shown in Figure 2. Foam capabilities are often added in areas where liquid pool fires might occur. Deluge systems are most appropriate where fast-developing fires might occur. These systems utilize open

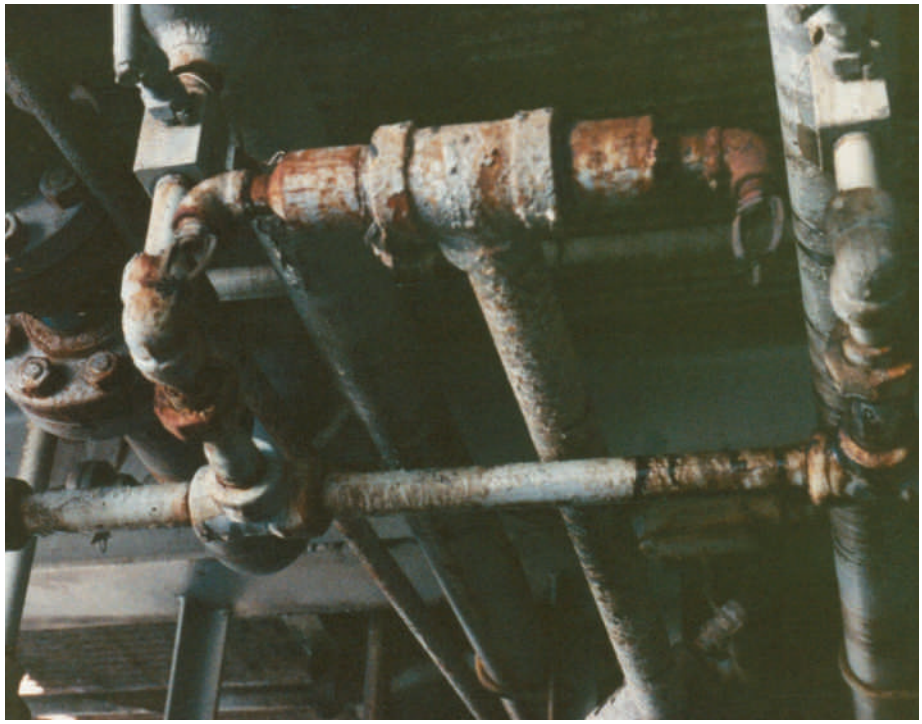

Figure 3. Rolf Jensen & Associates Inc.

spray nozzles supplied by a piping system that is supplied with seawater through a normally closed deluge valve. Upon alarm the deluge valve is opened and water is supplied to the spray nozzles over the hazard. Seawater systems are typically required as fresh water availability is limited and high water flow rates are needed for high challenge hazards. Corrosion presents a serious concern as the piping is open to the atmosphere and, at times, filled with seawater. This is a particularly corrosive application with typical results using steel piping systems clearly shown in Figure 3. Some facilities opt for copper nickel piping and where allowed, some operators utilize fiberglass piping. To address fire exposure concerns, especially during the early stages when water is not yet flowing in the pipe, fiberglass piping is provided with an increased fire resistance.

MONITORS, SPRINKLERS & HOSE STATIONS

Monitors, sometimes referred to as water cannons, are also used on facilities in the drilling or well test areas to provide additional protection. These monitors are more awkward to locate than on land facilities due to the congestion on offshore oil rigs. If used, sprinkler systems are fed by fresh water fire pumps and protect the accommodation areas where slow growth fires are more likely. While fresh water storage is limited, it is usually adequate for this relatively light hazard.

Hose stations, supplied by the fire main, are located throughout the facility so that all areas are reachable with a length of pre-connected hose. Some operators utilize hose reels with a special provision for introducing Aqueous Film Forming Foam (AFFF). The foam concentrate is stored in sealed buckets adjacent to each hose reel. The buckets can be pierced with an induction nozzle device that is connected to the hose reel. In the event of a flammable liquid pool fire, the addition of foam can increase the fire fighting effectiveness dramatically. Due to the size and risk involved, the helideck area is often protected with a large fixed AFFF system that employs large storage tanks and a number of well-placed monitors at key locations on the helideck perimeter.

FIXED SUPPRESSION SYSTEMS AND EXTINGUISHERS

Enclosed oil rig spaces make good candidates for water mist or gaseous extinguishing systems due to their tight construction. Water mist systems following NFPA 750 are emerging as a possible candidate for machinery enclosures and electrical rooms. Typically, if protection is provided, it is a fixed gaseous system utilizing one of the clean agents following NFPA 2001, “Clean Agent Fire Extinguishing Systems.” While few, if any, new halon systems are installed, a number of facilities have existing halon systems Fire extinguishers are provided throughout the facility with the type of extinguisher based on the hazard of the space protected.

DETECTION AND ALARM

A vital element of the protection of oil rig facilities is the fire and gas detection and alarm systems. These systems sound an alarm and, if appropriate, initiate a response from the facility fire brigade or even initiate the facility emergency shutdown (ESD) system. The alarm information may be transmitted to land based facilities automatically or via the radio operator, but the main response is from on site staff. The most commonly referenced guidelines for automatic detectors are from the American Petroleum Institute, (API RP 14C, RP

Figure 4. Rolf Jensen & Associates Inc.

Pic: Rolf Jensen & Associates Inc.

14G and RP 14F). Combustible gas detectors are typically set at 20% and 60% of the lower explosive limit and are located in areas subject to possible leaks and at fresh air inlets to non-classified areas. Protected areas include the wellhead, well floor, process equipment, degasser, shale shaker, and mud processing areas.

These are a vital element of the fire protection program as they allow operators to shut off the fuel supply or take other appropriate action before flammable conditions exist. Flame detectors are often provided in process equipment areas. Some manufacturers have developed detector housings that are more water resistant and are better suited to the hostile and wet marine environment. The article "Flame Detectors" by Dr. Eliot Sizeland in Issue 1 of the International Fire Protection Magazine (See website www.ifpmag.com) provides a clear insight into the latest trends, describing the advantages of the multi-spectrum infrared detectors. The alarm system may also detect toxic gases, such as hydrogen sulfide, which may be produced as part of the process (API RP55). Smoke detectors are usually provided in control rooms, switchgear rooms and other enclosed areas where slow developing fires might occur. Manual fire alarm stations are provided throughout the facility to allow for activating the general fire alarm signal, a signal that is distinctive from any other emergency condition.

FIRE CONTROL PLAN

The above systems are clearly laid out on a fire control plan that is usually posted in a public area within the accommodations. This plan usually includes a layout of the entire facility identifying: fire rated bulkheads and decks, detection and alarm equipment, sprinkler systems, fire extinguishers, exit paths, fan controls and dampers.

SUMMARY

Oil rig fire protection follows regulations that are mostly prescriptive in nature and coordinate well with marine standards and codes. Typically an authority having jurisdiction grants approval of the drawings and provides periodic audits of the facility. It has long been recognized that while the frequency for fires is relatively low, the potential for large loss in human and financial terms is quite high. There has been an increasing focus on safety management techniques. There is a trend to integrate the fire protection design and personnel training to form a more holistic approach to safety, addressing not only the technical requirements, but also organizational and human performance issues. Figure 4 shows one training facility where a pool fire below a set of stairs is used to help train firefighters in extinguishing techniques. With any system it is not only necessary select the proper equipment, provide design appropriate to the hazard, it is also important to ensure that the installation is tested and maintained and that operators are knowledgeable and trained as to its operation. Information on these emerging approaches can be found in the "Guidance Notes on Risk Assessment Applications for the Marine and Offshore Oil and Gas Industries" published by the American Bureau of Shipping (ABS). As we continue to push the limits in our exploration for oil, it is appropriate that we keep expanding our capabilities in protecting against the hazards of fire.

GARY PIERMATTEI, P.E. *is a Senior Consulting Engineer with the San Francisco Office of Rolf Jensen & Associates, Inc. He has worked on a variety of marine facilities in Europe, North America, Asia, Australia and New Zealand. These facilities include fire fighting vessels, mobile offshore drilling units and fixed production platforms. Mr. Piermattei holds a degree in Mechanical Engineering from the University of California, Berkeley and is a licensed fire protection engineer and mechanical engineer. He serves on two NFPA committees: "Water Spray Fix Systems For Fire Protection," (NFPA 15) and "Installation Of Foam-Water Sprinkler and Foam-Water Spray Systems" (NFPA 16). To learn more about RJA, visit their website at www.rjagroup.com.*

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FIRE SAFETY CABLES

Pic: Dätwyler (UK) Ltd.

By GRAHAM SMALL,
Sales Manager, Dätwyler (UK) Limited

Cabling is a real mine field for jargon; not least of which in relation to the properties of cables in a fire. Users and specifiers should be aware of the correct terminology particularly in specifying cables with low smoke emission, reduced fire propagation and minimal toxicity. Some of the more popular terms include:

- Halogen-free
- Flame and Fire Retardant
- 'Low Smoke, Zero Halogen'
- 'Low Smoke and Fume'
- Fire Resistant

We should be aware of the characteristics that are important to us as a user of these cables (below):

Any cables used within public buildings should, as a minimum requirement, present no danger to the health of people or integrity of property through acid gas emissions during a fire. They should also be self-extinguishing, that is, not continue to burn once the source of fire is removed and neither should it propagate fire into new areas. Further, while burning – and of course *everything* will burn given the right conditions – the smoke produced should not impede escape by obscuring emergency lighting and exit signs.

Most modern communications cables and those used for emergency systems – such as fire alarm circuits, public address, emergency lighting etc – are available with LSOH-FR sheathing (i.e. Low Smoke, Zero Halogen and Flame Retardant). However, PVC continues to be used because of lower pricing and general ignorance of how PVC behaves in fire conditions. Internal cabling favours PVC instead of polythenes and rubbers because unlike these other materials they will quickly extinguish themselves once the source of fire is removed or extinguished. Unfortunately, the halogens in PVC that exhibit this property produce corrosive byproducts such as hydrochloric acid that is fatal both to humans and sensitive electrical equipment as found in computers for example. Even quite small fires can produce enough acidic fallout to destroy electronic equipment in buildings.

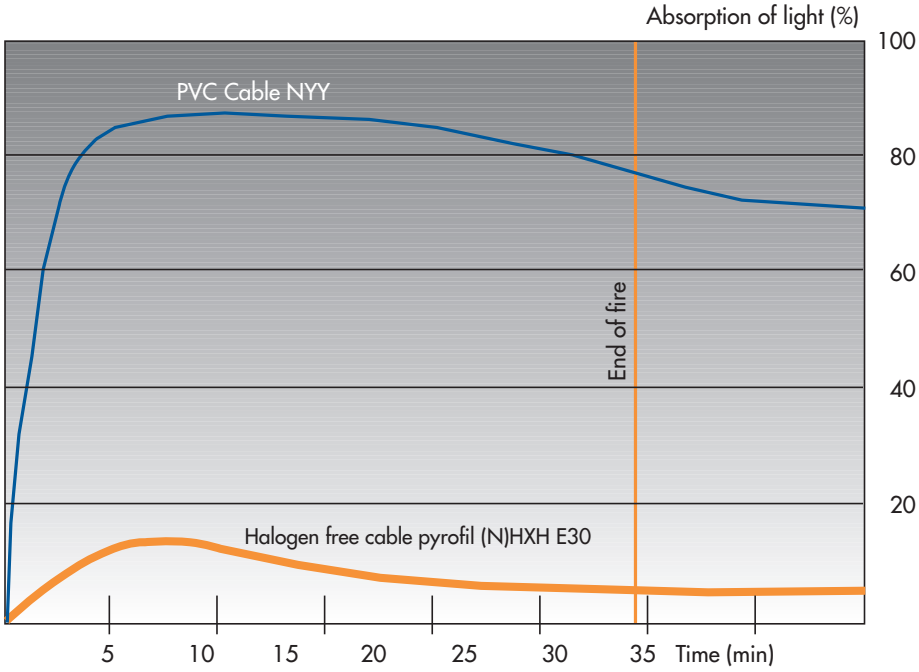
Fire Safety Aspects

- No damage to health or property by acid or corrosive gases
- Self-extinction of flames when fire source is removed
- No propagation of fire from one location to another
- Sufficient visibility for evacuation of occupants and for fire fighting

Required Characteristics

- Zero halogen, no corrosive gases
- Flame retardance
- Reduced fire propagation
- Minimum smoke emission

FIRE SAFETY CABLES

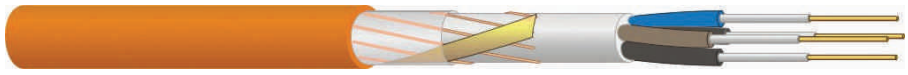


Graphic: Dätwyler (UK) Ltd.

The table right shows the difference in light absorption between smoky PVC cable (blue curve) and DätwylerLSOH-FR cable (orange curve). After 5-7 minutes opaque smoke from an LSOH-FR cable will cause a peak 15% deterioration in light transmission settling to around 5% compared to a 90% deterioration over an extended period for PVC sheathed cable.

The majority of standard building cable used in the UK – even where LSOH-FR types are installed – will lose their functionality in a fire very quickly. That means that even if the cable poses no threat or hazard to people or building systems they will cease to provide a circuit quite quickly. Therefore, emergency systems such as public address, lighting, heat and smoke extraction and special lifts for fire-fighters need to be protected to ensure they will continue to function for a period of time during a fire.

The *fire resisting* property of cable is measured in the UK by British Standard BS6387. This takes a 600mm length of cable and subjects it to a flame of 950°C for 3 hours while carrying 3 amps of current. The specification also emulates fire conditions by subjecting the burning sample to water spray and mechanical shock (categories C, W and Z respectively). A further specification – BS7629 – combines this fire survivability with low smoke and toxicity emission. Similar tests exist in Europe, such as IEC 60331 that concentrate on fire performance only.



Graphic: Dätwyler (UK) Ltd.

Pic: Dätwyler (UK) Ltd.

Traditionally, fire-resisting cables such as MICC (mineral insulated, copper clad) have been used to provide robust links in fire protection systems. Often described as 'fire survival' cables they utilise mineral-based insulation and copper tube technology. Although such cables are of a high quality and robust, they are more difficult to install than alternatives.

Several years ago, a 'soft skin' approach to fire-resistant cables was introduced. Such cables are more akin to those usually installed by electrical contractors. They use thermoplastic materials and fire resisting tapes, rather than copper tube technology. Clearly these cables offer a more flexible design and are easier to install. They do not require such highly skilled technicians to install them since the required installation techniques are little different from those employed on lighting circuits.

Both solutions have their merits. The consultant or fire engineer has to weigh up the requirements of each specific installation, balancing the need for effective safety critical circuits (that will facilitate evacuation and property protection) against the available budget. A further issue relates to the way in

FIRE SAFETY CABLES

which the standard tests the cable. At present, only power transmission performance is assessed. This needs to be amended to address the data transmission performance. This is all-important for modern addressable fire detection and alarm systems.

However, current fire-related cable standards deal only with the combustion of cables and not with the continued functionality of the life and property protection systems they interconnect. UK standards such as BS6387 and BS7629 seek to ensure that cables used in fire detection and alarm circuits (BS5839) and emergency lighting (BS5266) for example meet fire resistance, smoke and toxicity emission's and propagation criteria. Even the 'new breed' of composite 'EN' standards, such as EN50200, addresses these issues from a component-based viewpoint. As these standards do not emulate the thermal and dynamic stresses on cable and its supporting infrastructure during fires the assumption that these cables can maintain circuit integrity for extended periods in fire conditions is a dangerous fallacy.

Cabling practice for life-safety and property protection circuits too often fall far short of ideal. For example, over-loaded tray, fixing points too far apart, plastic cable ties and plastic dowels far too often compromise the integrity of the circuit before the cable is threatened. While the importance of selecting fit-for-purpose cables cannot be over-stressed, their performance in fire conditions can be ruined if insufficient attention is paid to their fixing and management. Cables with thermoplastic terminal blocks used for jointing may suffer open or short-circuit failure when the fire heats the terminal block. Cables may lose their support if not effectively fixed with fire-resistant clips or other reliable support means. This is an easily overlooked aspect of installation that may not come to light until the system is called upon to work in an emergency. Moves to regulate installers of such systems via the ECA/BFPSA sponsored training and accreditation scheme, to replace the failed LPS1014 initiative, is a welcome move.

Pic: Dätwyler (UK) Ltd.

German standard DIN4102 part 12 seeks to ensure the continued operation of cable systems in fires up to 1000°C. Similar in approach to our own BS476, the DIN standard subjects a range of electrical cable (from <225V to 0.6/1kV) and cable management methods to an ISO834 time/temperature curve. The furnace reaches 830°C after 30 minutes and 1000°C after 90 minutes. In this way, one gets a measure of the systems integrity at high temperatures; bearing in mind that the steelwork starts to deform above 600°C!

We are aware that any DIN standard will not be popular in 'BS' dominated markets. However, this performance-based standard is gaining ground in other European markets such as Netherlands, Luxembourg, Poland, Austria and even Greece. It is seems likely that momentum will move CENELEC to adopt this as a mandate for a draft EN proposal in the near future.

We concede that this particular standard does not take into account the actions of water (from sprinkler systems) or shock (from falling objects). However, cables meeting this systems-based performance standard will also meet the component-based standards described herein. In the absence of any other suitable standards it remains a valid reference point for those concerned with the fire performance of their building and adds a welcome tier of confidence in essential systems design.

Pic: Dätwyler (UK) Ltd.

A cable-based fire survival test coupled with a demonstrable and repeatable method of assessing the installation hardware would give consultants and fire engineers a more practical benchmark to assess the suitability of systems for their projects. If this can be coupled with a recognised installer accreditation scheme then we can all be better assured that we and our families are better protected in buildings we frequent.

AFD systems vendors, too, are considering the effects of fire on the performance of systems. The continual evolution of fire protection system performance will inevitably impact on the performance required of cables and the requirements specified in the relevant cable standards. Specifiers and manufacturers will need to address issues concerned with reliable provision of bandwidth in fire conditions. Indeed, manufacturers are looking to optical fibre to provide the necessary resilience in the next generation of life and property protection systems.

We can never hope to demonstrate in a test what happens in a real fire. Every fire is different; every building is different and every installation is different. We in the industry are dealing with issues of confidence. Anything that moves the focus away from component-specific arguments to a consideration of the place of cable in the greater scheme of things must be encouraged. Suppliers of cable systems must seek to provide solutions that meet the needs of the fire engineer and the requirements of the building under consideration. As every installation is unique then the industry should be in the business of providing solutions not confusion.

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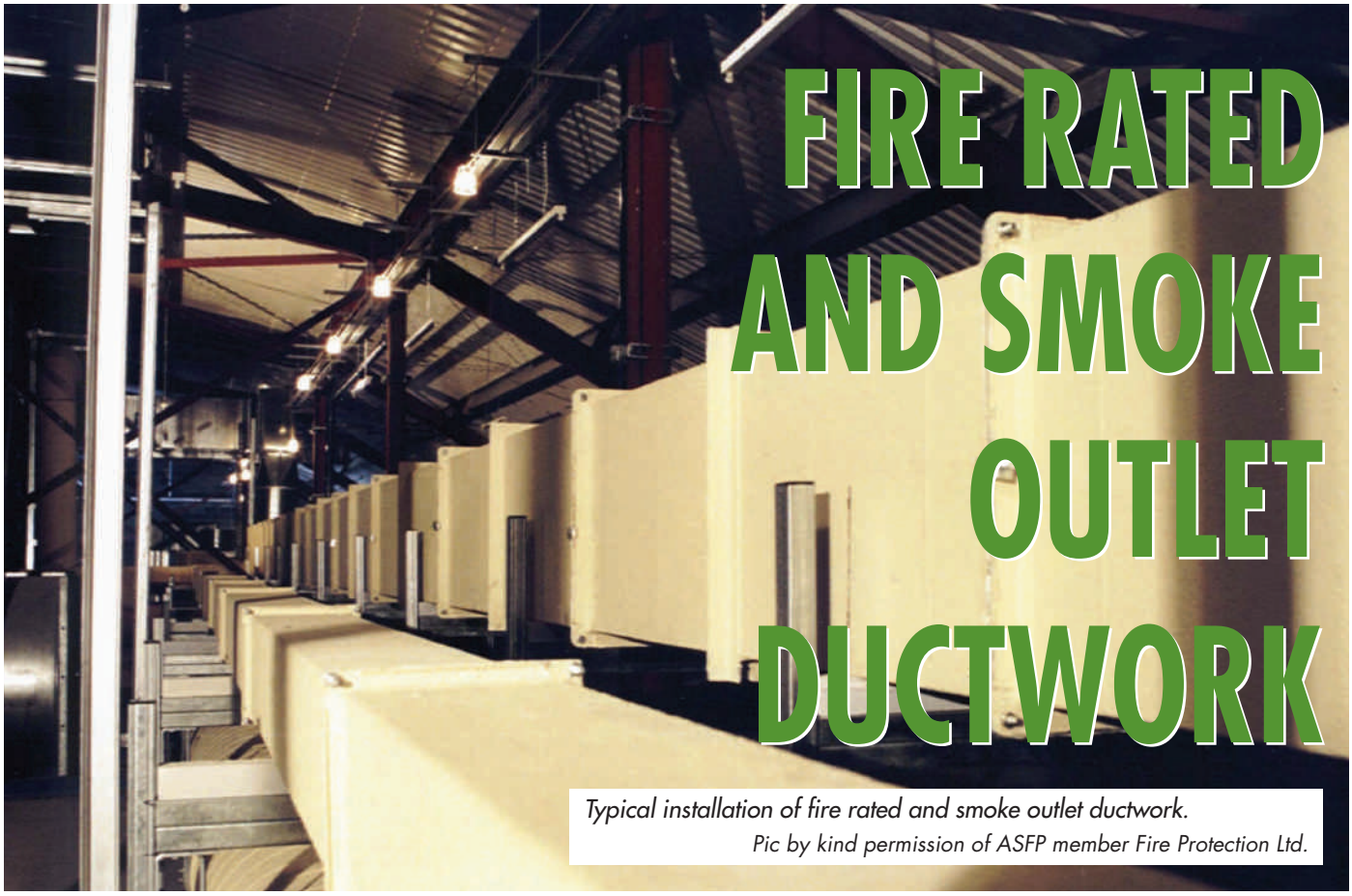

FIRE RATED AND SMOKE OUTLET DUCTWORK

Typical installation of fire rated and smoke outlet ductwork.
Pic by kind permission of ASFP member Fire Protection Ltd.

BS 5588 Part 9 paragraph 7.5.1 acknowledges that steel ductwork **"if satisfactorily constructed and supported"** will be able to provide a high degree of resistance to the passage of smoke and decomposition products. Rapid heat transfer through the steel however, **regardless of its thickness**, prevents the ductwork achieving any degree of fire resistance without supplementary insulation. A satisfactorily constructed and supported steel duct is one **proven by test and/or assessment to BS 476: Part 24**. Why then do we see so many "fire rated ductwork" installations installed that are deficient?

By Ron Smith

Introduction

In 1987 the British Standards Institution introduced Part 24 to the BS 476 series of fire tests. This was a method for determination of the fire resistance of ventilation ducts. The standard has an annex which gives guidance on the fire performance criteria required for kitchen extract and smoke outlet applications, which differ from the requirements for ventilation ducts. It is therefore vitally important, when assessing the suitability of a proposed system of fire rated ductwork, that the performance of the proposed system matches the requirements of the application for which it is required. For example, a smoke outlet duct is required to maintain a minimum 75% of the original cross section when tested to BS 476: Part 24 (ISO 6944).

Car parks and non-domestic kitchens are required to have separate and independent extraction systems, because of the polluted nature of the extracted air. As BS 5588: Part 9 recommends that fire dampers should **not** be installed in extraction ductwork serving car parks or kitchens, any duct or ductwork penetrating fire resisting barriers in such installations should be fire resisting.

Kitchen extraction ductwork presents a particular hazard in that combustible deposits, such as grease, are likely to accumulate on the internal surfaces of the ductwork. A fire in an adjacent compartment through which the ductwork passes could therefore initiate a fire within the ductwork, which in the absence of fire dampers might prejudice the safety of the kitchen occupants. For this reason BS 476: Part 24 imposes an additional requirement for kitchen extract ductwork. The internal surface of the ductwork within the furnace, i.e. when tested as a type A duct against external fire, **must** meet the insulation criteria. It is also essential that this particular type of ductwork is provided with access for cleaning at distances not exceeding 3m.

Fire Resistance Test on Ducts

As indicated above, standard fire resistance tests on ventilation ducts are carried out in accordance with the requirements of BS 476: Part 24. The standard specifies a method of test and criteria for the determination of the fire resistance of both horizontal and vertical

Typical installation of fire rated and smoke outlet ductwork.
Pic by kind permission of ASFP member Fire Protection Ltd.

ventilation ducts under standardised fire conditions. The purpose of the test is to measure the ability of a representative sample of ductwork, or ductwork assembly, to resist the spread of fire from one compartment to another. The test is applicable to vertical and horizontal ducts, with or without branches, and takes into account joints, air supply and exhaust openings as well as suspension devices and penetration seals. The tests are conducted without dampers.

The specimen(s) used in the test must be designed and constructed to be representative of how the ductwork would be constructed on site. Two ducts are tested, one with fire from the outside only (type A) and one with fire on the inside (type B). Both ducts may be tested in either the horizontal or vertical plane. The test specimen(s) is subjected to fire on all four sides using the standard temperature/time curve detailed in BS 476: Part 20.

The tested duct assembly is judged against the three performance criteria used for fire resistant barriers – i.e. stability, insulation and integrity. The requirements for these criteria are as given below.

Stability: failure shall be deemed to have occurred in duct type A within the furnace, and in duct types A and B outside the furnace, when the duct collapses in such a manner that the duct no longer fulfils its intended function.

As previously stated a smoke outlet duct must also retain a minimum of 75% of its internal cross sectional area throughout the test.

Insulation: failure is deemed to have occurred when the temperature rise above initial ambient air temperature on the unexposed surface of the duct, outside the furnace, exceeds either,

(i) 140°C as an average value, or
(ii) 180°C as a maximum value

As stated before, for kitchen extract ducts (type A), these temperature rise limits also apply to the inside surface of the duct within the furnace.

Integrity: failure shall be deemed to have occurred if any cracks, holes or other openings, outside the furnace, allow hot gases or flames to pass through the duct walls. Integrity failure is based upon the requirements of BS 475: Part 20. These are,

(i) when a 6mm diameter gap gauge can penetrate through a gap and can be moved in that gap for a distance of at least 150mm
(ii) when a 25mm diameter gap gauge can penetrate through a gap

Integrity failure shall also be deemed to have occurred when the cotton pad defined in ISO 834 is ignited, or when sustained flaming for at least 10 seconds appears on the unexposed surface of the test specimen outside the furnace.

It is recognised in the UK that the results of the above test(s) for horizontal ductwork, types A and B, are applicable to horizontal ducts only. Similarly, a test result obtained for vertical ductwork, types A and B, is applicable to vertical ducts only, without a horizontal branch. However, if a vertical test on horizontal ductwork type A, with a branch, has been successful, the ductwork may include a horizontal branch without further testing. These specific points appear to be misunderstood when "evidence" of successful fire tests has been presented to the specifier or main contractor.

Support Systems – Horizontal Ducts

Horizontal ductwork is normally supported along its length by a system of steel framework, attached to the building structure with fire resisting fixings. This framework generally consists of vertical hangers connected to a horizontal member, or members, with the hangers being fixed to the building structure above the ductwork. It is possible to use unprotected steel hangers, provided the calculated stresses do not exceed the values given below.

ALLOWABLE TENSILE STRESS

	Up to 60 minutes	Over 60 minutes Up to 120 minutes	Over 120 minutes Up to 240 minutes
Tensile stress in all vertically oriented components	15 N/mm^2	10 N/mm^2	6 N/mm^2

The stress should be calculated from the supported load only and if hanger is a threaded rod the cross sectional area should be based upon the root diameter of the rod.

Penetration Seals

It is well recognised that it is of prime importance to maintain fire resistance of a supporting construction at the point where the ductwork passes through the construction. In this respect, the current UK test method

considers the seal around the ductwork, where it passes through the surrounding construction (wall or floor), to be an **integral** part of the duct construction. The penetration seal must, therefore, be constructed of the same material and installed in the same manner **as that tested.** The dimension of the "gap" between the inside edge of the supporting construction and the perimeter of the ductwork must also be the same as that tested.

This is where, on site, a problems occur in that the "seal" often consists of mineral wool (or even worse – glass wool) being "stuffed" around the ductwork to provide the required seal. This is not acceptable as a fire resistant seal and should not be allowed. If a mineral wool seal has been tested in conjunction with the specific ductwork being installed, the density, resin content, etc, of the mineral wool must be clearly defined. Reputable manufacturers' and installers of fire rated ductwork will use the sealant used in the fire test, or will have obtained an assessment from a fire test laboratory for the seal they use.

Dampers

Where ductwork passes through a compartment wall or floor it must be ensured that the fire separation of the wall or floor is maintained. This can be achieved in one of two ways.

- The fitting of a penetration seal around fire rated ductwork.
- The fitting of a fire damper in the plane of the wall or floor when non-fire rated ductwork passes through the separating element. It is important to ensure that the damper and seal used must be installed to a system substantiated by test or assessment. **The damper MUST be mounted in the wall or floor and MUST be supported/restrained independently of the ductwork.**

On many sites this requirement has been ignored and dampers have been fitted away from the separating element, have not been independently supported and have not been properly sealed. In a fire situation there would be total failure of the system and yet this practice is allowed to continue

Great Northern Development, Manchester. *Pic: Senior Hargreaves*

News International London.

Pic: Senior Hargreaves

unheeded in the UK by those responsible for the construction of the building(s).

Other Items of Importance

(i) General purpose ventilation/air conditioning ductwork cannot be utilised as, or converted into, a fire rated ductwork system unless the construction/materials of the whole system are proven by test or assessment in accordance with the requirements of BS 476: Part 24.

(ii) In the case of an **existing metal duct,** where the application of a fire insulation cladding material is being considered in order to provide fire resistance, it is imperative that the construction standard of the metal ductwork is checked for conformity with the appropriate fire test report. Similarly, the construction of newly erected metal ductwork should be subjected to the same scrutiny. Metal gauge, spacing and size of flanges and stiffeners, bolting centres, use of steel/aluminium rivets, sealants, spacing of hanger supports and fixing method to the soffit should all be checked for compliance with the fire tested construction. It is **not** sufficient to rely on a DW 144 (142) construction classification for fitness for purpose in this respect.

(iii) The element of building construction to which the support systems are attached must have a fire resistance of at least that specified for the fire rated ductwork and should be able to support the ductwork in a fire situation.

(iv) The fire resistance of fire rated ductwork should be expressed as three time period components. These, as previously described, are stability, integrity and insulation. Where only a single time period is expressed it shall be deemed to apply to all three periods.

(v) Fire rated ductwork tested to BS 476: Part 24 (ventilation ductwork test), which meets criteria of stability, integrity and insulation, may not be suitable for kitchen extract application or smoke extract application unless proven by additional test criteria.

Further information regarding fire rated ductwork is contained in the Association for Specialist Fire Protection publication **"Fire rated and smoke outlet ductwork – an industry guide to design and installation".** Copies can be obtained from the Secretariat at Association House, 235, Ash Road, Aldershot, Hampshire, GU12 4DD. Telephone: 01252 321322, Fax: 01252 333901, e-mail: **info@asfp.org.uk**

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FOAM AND FOAM SYSTEMS FOR PROTECTING STORAGE TANKS

By **Phil Bayliss**, Firemain Engineering Ltd

With the ever increasing financial pressures bearing down on the Worldwide Petroleum industry, we see the effects of the requirement to cut costs by reducing manning levels, increasing automation and in the case of storage tanks: building larger, more cost effective tanks to hold more fuel. It is now common for "new build" floating roof tanks to be in excess of 100 metres in diameter, whereas twenty-five years ago a 60-metre diameter tank was considered large.

The contents of storage tanks in the Oil industry is predominantly Hydrocarbon based. Fire officers have long seen the benefits of using foam as the major means of fighting fires in all forms of tanks; Fixed Roof, Floating Roof, Vertical or Horizontal. There are many ways in which we can utilise fixed and portable methods of foam application. Recently, we have seen the rise of a greater variety of process chemicals resistant to conventional foams being stored in tank farms, such as Alcohols and Polar Solvents. (Not only are they used in Petrochemical and Pharmaceutical processes but in Oil Refineries as OCTANE BOOSTERS for petrol). The main response to this change has been for many Refinery Fire Brigades to standardize on "AR" (Alcohol Resistant) type foams which can be used on hydrocarbon and Polar Solvent Chemicals. The cost increase to achieve this often puts pressure on the Fire Protection Budget, as "AR" foams can be 3-4 times the cost of their predecessors!

Foam concentrate manufacturers are currently responding to this commercial pressure by offering the next generation of foam concentrates known in the trade as "1 x 3" which loosely translates as:

FLAMMABLE HYDROCARBON CHEMICALS = 1% FOAM : 99% WATER
FLAMMABLE POLAR SOLVENT CHEMICALS = 3% FOAM : 97% WATER

The days of 6% foam concentrate seem numbered. Why store 6 times the volume, when you can use 1% foam? The logic seems simple, but does the proportioning equipment match?

Of course many Fire Brigades, both industrial and municipal, have only recently taken the step to use "3 x 3" versions of AR-AFFF's and AR-FFFP's. With the exit of the 3M corporation from the foam concentrate market it would seem that there are a lot of big decisions to be made about which foam concentrate type to be used when formulating a Foam Fire Fighting Strategy. Whilst the Foam Concentrate manufacturers may wish to promote a 1% foam concentrate, it will be another question to decide about the level of accuracy tolerance on 1% Foam Proportioning devices. The margin for error on a 6% foam proportioner of + or – 10% can be acceptable, but what guarantees would an equipment manufacturer offer on a 1% device on a cold day with a drum of viscous AR-AFFF to proportion accurately? It is clear that equipment manufacturers will have to match their equipment to the performance that will be demanded by the Foam Concentrate manufacturers. In reality though, most of the large Foam

FOAM AND FOAM SYSTEMS FOR PROTECTING STORAGE TANKS

Concentrate manufacturers are also manufacturers of equipment and consequently will perform their in-house testing on matching the performance of their own brand of concentrate to that of their own brand of proportioning and delivery equipment.

As if all this was not enough to consider when deciding on which foam to specify there appears the topical issue of foam and the environment. The proliferation of discussion in this whole arena seemed to have escalated with the 3M decision to pull out of foam production in May 2000.

This event however only highlighted one particular chemical in a blend of many from one manufacturers recipe, namely "PFOS". It seemed more associated to the levels of this chemical being present in the production of the foam rather than the fire-fighting environment. The bio-accumulation issue was surely related to constant exposure to PFOS during the manufacturing process, not when a fire fighter is spraying 97% water and 3% foam on to a blazing oil fire in a Refinery! As a consequence of mighty U.S Corporation's actions, there seemed to be a higher degree of debate and even confusion within the market place about how environmentally friendly foam concentrate actually is. In the UK, the level of questions about this subject prompted the British Fire Protection Systems Association (BFPSA) to release a statement, by way of a press release, to inform the users and specifiers of foam concentrate of their continued confidence in the use of foam as a primary fire fighting agent. This endorsement alone is one that most users of foam must have welcomed.

When assessing the total fire strategy of protecting storage tanks a comprehensive pre-incident plan is required. How far this plan goes to prepare for a worst case scenario will dictate how efficient the petrochemical facility will deal with and recover from the emergency and return to normal. The options available to include in a strategy are many and will vary dependant upon circumstance, geographical locality or plain budget.

Assuming the facility to be designed in accordance to a Flammable and Combustible Liquids Code such as NFPA 30, and that suitable tank maintenance procedures are followed, the strategy can call upon guidelines for protection contained with documents such as NFPA 11 or API 19 which cover aspects of cooling spray rates for the mitigation of radiated heat from one tank on fire to its close neighbour, right through to calculating the quantity of foam concentrate to be stored and the type of foam delivery equipment to be used.

The options can be summarized in the following categories

- DETECTION & ALARM SYSTEMS
- DETECTION & FIXED SUPPRESSION SYSTEMS
- FIXED FOAM POURER/BASE INJECTION SYSTEMS
- FIXED AND MOBILE FOAM MONITORS
- EXTERNAL BRIGADE ASSISTANCE

In considering the above, an assessment of the site facilities is also required.

- AVAILABLE TRAINED FIRE FIGHTERS?
- AVAILABLE WATER SUPPLIES, PUMP CAPACITY AND FIREMAIN INFRASTRUCTURE
- DISTANCE FROM EXTERNAL FIRE BRIGADE BACKUP
- FREQUENCY OF INCIDENTS (such as lightning strikes)
- LEVEL OF FIXED FOAM SYSTEM PROTECTION
- FINANCIAL BUDGET

One can easily see that strategies will differ from say, a remote equatorial petrol tank farm, with poor water supplies and no trained fire fighters; to a Refinery with its own brigade, situated close to an urban municipal brigade in a cold climate.

Equally, one financial budget may dictate that, early detection and suppression of fires in the incipient stage, may be preferable to investing in large pumps, hoses and portable monitors for fighting fires once they become large incidents. The adverse publicity and consequential loss of product or production surrounding major tank fires should also have a great effect on deciding which way the desirable route should be.

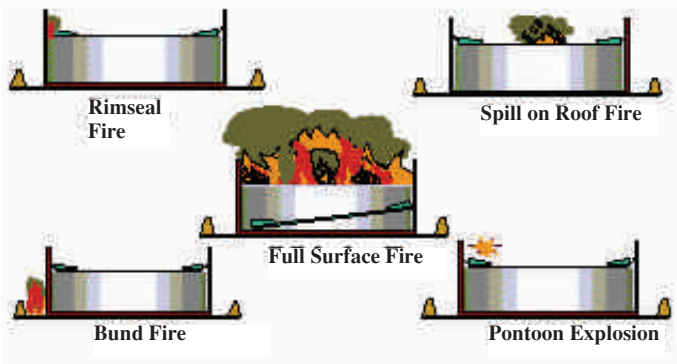
The availability of foams and application equipment has never been better. High quality concentrates and Foam Systems are available worldwide with well-documented success. There are many ways to deliver foam for fire extinguishment. These include:

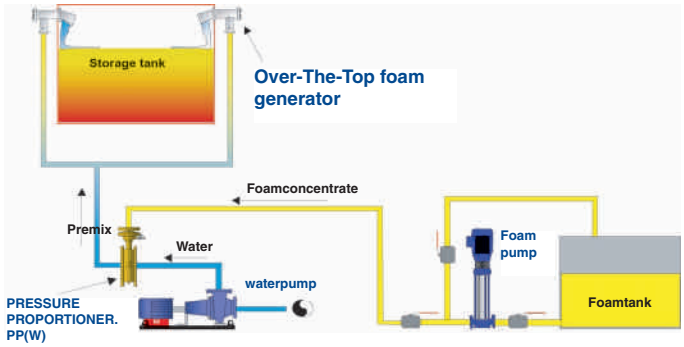
FLOATING ROOF TANKS

- **Detection and Foam Suppression Stand Alone Units.** Usually Nitrogen powered with telemetry back to the control room. Small foam vessels are located on the roof to protect the Rimseal Area. The advantage of the combined detection system is its speed of response.
- **Over the Top Pourers** provide low expansion foam to the Rimseal foam dam area. Can be fed from a Central Foam Proportioning System or from a Mobile Foam Tender. Can be linked to Linear Heat Detection or can be manual.

- **Large Foam Monitors** i.e. 20,000 LPM with throws in excess of 100 metres, requiring large hose feeds, foam tanker deployment and water supplies. Used for fully involved Floating Roof Tank fires.

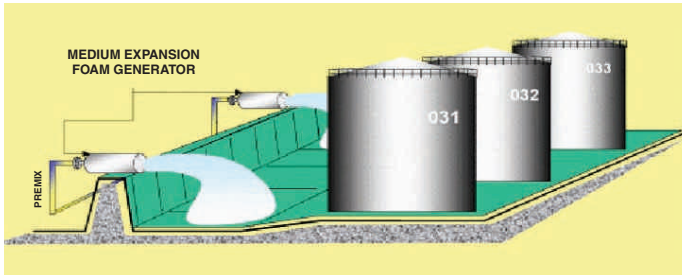
CONE ROOF TANKS



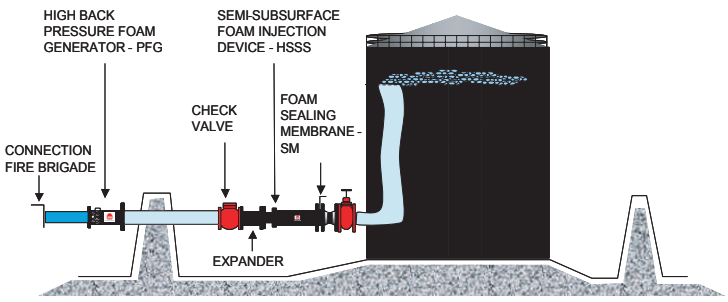


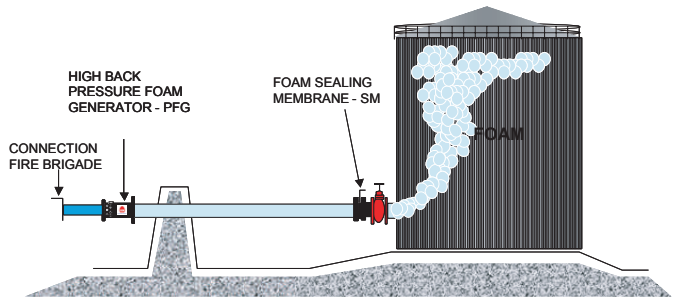
- **Over the Top Pourers**, protecting the full fuel surface and incorporating a vapour seal between the tank and supply pipework. Can be subject to explosion damage.
- **Base Foam Injection Systems** are situated remotely from the explosion area. Rely on forcing low expansion foam through the base of the tank up to the fuel surface.
- **Semi Subsurface Base Foam Injection Systems** incorporate a High Back Pressure Generator and an internal floating delivery hose to apply foam to the surface of tanks containing foam destructive chemicals such as Methanol or Acetone. A gentle foam application results in faster extinguishment. A plunging foam application is a less efficient method of delivery.
- **Mobile Equipment** such as Monitor Trailers and Refinery Vehicles with Monitors, as with Floating Roof Tanks require a critical deployment factor, involving a sufficient quantity of foam concentrate and water in the right application rate or deployment will usually not succeed. Using Monitors invariably means using a large quantity of foam concentrate.

BUNDED AREAS



Bunds or dikes can represent the potential for large surface areas containing spilled fuel. That is what they are designed to do, to contain the full volume of a tank or multiple tanks.





This area is not as well defined within international standards for fire fighting as with tanks, BS5306 : Section 6.1, does propose the parameters for foam protection. In reality the variety of methods utilised for bunds can vary from a small mobile foam trolley being manually connected to a local hydrant to a complete foam pourer system. By far the most practical way to fill a bund with foam is to use Medium Expansion pourers; the expanded foam fills and contains the area with an economical use of foam concentrate.

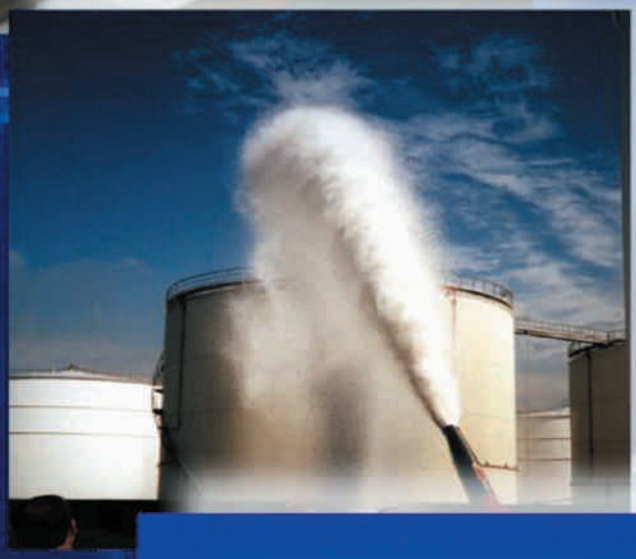
As with many Fire Protection strategies, Storage Tank Fire Suppression and Extinguishment will benefit from early detection, fast response, accurate delivery of the fire fighting medium and a planned response to the escalation of small incidents involving back up measures for major fully involved tank fires.

There is often a debate about whether to use fixed or portable equipment. The simple answer is; you have to have both! One might see fighting fires as spectacular and courageous, but cost for cost, fixed systems are about the same price, can fight fires in more than one place at a time and have a shorter response time than portable systems. If your fixed system has "gone up" in an incident then the back up provided by portable equipment is worth a million dollars!

As with many Fire Protection strategies, Storage Tank Fire Suppression and Extinguishment will benefit from early detection, fast response, accurate delivery of the fire fighting medium and a planned response to the escalation of small incidents involving back up measures for major fully involved tank fires.

The merits of foam as an extinguishing media for fires in storage areas will continue for many years, new foam and equipment technology will be introduced. The low frequency of large tank fires is proof that foam systems work, it's unfortunate that we don't hear of the countless times that small fires have been stopped before developing into big ones.

TANK PROTECTION



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FSSA news

FSSA to Celebrate 20th Anniversary

The Fire Suppression Systems Association will celebrates its 20th anniversary February 6-10, 2002 in Marco Island, Fla. Themed "Celebrating our Past, Shaping our Future," the group's annual meeting is the leading forum for leadership training, technical information and networking opportunities in the special hazards field.

Bob Moawad, chairman and CEO of the Edge Learning Institute, will be the meeting's keynote speaker. Moawad is a tireless teacher, coach, leader, speaker, author, innovator, benefactor, visionary and consultant. He has presented to nearly three million people worldwide and will discuss how attendees can effectively shape their futures to compete in an ever-changing business environment.

The meeting also features a presentation on essence marketing by Charles Stuart. Nationally known for his work in strategic marketing concepts, Stuart consults with dozens of companies throughout North America, helping them achieve dramatically increased profits, long-term customer relationships and better marketing and sales teams.

Visitors will receive updates on the latest changes in standards and regulations impacting the special hazards business around the world. FSSA will host open forums where participants can discuss topics important to their businesses.

Meeting visitors will also receive updates on the latest changes in standards and regulations impacting the special hazards business around the world. FSSA will host open forums where participants can discuss topics important to their businesses. Time allowed for this session has doubled this year in response to member requests. Finally, there are a number of concurrent workshops from which to choose on topics including NICET certification, personnel issues, technical issues and management.

The Hilton Marco Island Resort will host the event. Complete details and registration information are available online at www.fssa.net.

Technical Training Seminar

Due to the events of September 11, FSSA rescheduled its September 14 Technical Training Seminar for November 2-3, 2001. The Technical Training Seminar is an excellent opportunity for both field and office personnel to receive training in a number of areas. Topics to be covered at the seminar include carbon dioxide systems, NFPA standards 2001 and 72, inspection reports and licensing, clean agent applications, Halon and the Voluntary Code of Practice, NICET certification, cylinder safety, customer relations and FSSA's new Pipe Design Handbook.

Again, complete details and registration information can be found online at www.fssa.net.

Clean Agent Training Videos Available

FSSA is now selling a four-tape video training series on clean agent suppression systems. The tapes, produced by Protection Knowledge Concepts, Inc., are designed for anyone who designs, specifies, inspects, buys, approves or maintains clean agent systems.

Unit one covers the basics of special hazards fire suppression. It includes information on general building versus special hazards fire protection and answers some basic questions about clean agent systems. What are they? Why are they used? Where are they used?

The second tape addresses standards and regulations. It covers Halon issue, NFPA standards for clean agents, the EPA SNAP list, NOAEL and LOAEL and alternative clean agents.

The third tape covers alternative agents to Halon 1301. It addresses carbon dioxide, INERGEN, FM-200 and FE-13 systems.

The fourth tape covers maintenance and training issues. It addresses fire detection and alarm systems, basic maintenance of clean agent systems and personnel training.

This series is a must for anyone involved with clean agent systems. The cost for FSSA members is $299 per set. For non-members, the cost is $399 per set. To order your set of training videos, visit the FSSA web site at www.fssa.net or contact FSSA headquarters at 410-931-8100.

FSSA Piping Handbook Available

FSSA's Technical Committee has published the group's *Pipe Design Handbook for Use with Special Hazards Fire Suppression Systems*. The handbook features new design guidelines for use with all types of engineered special hazards systems where the Power Piping Code is specified.

"This is the most comprehensive piping handbook in the industry for use with special hazards fire suppression systems," says FSSA Technical Director Charles Willms, P.E. "It provides guidance for conditions not specified in NFPA standards."

The handbook is currently available in electronic form only. To order and download a copy, visit FSSA's web site at www.fssa.net.

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Are combustible plastics lurking in the construction of your facility?

In an increasing number of fires, plastic construction materials play a major factor in the loss. Peter Battrick examines the fire hazards associated with plastic building materials and the fire tests used to evaluate these

By **PETER BATTRICK**, *Staff Engineer, Fire and Hazards Group, FM Global*

Traditional building materials are increasingly being ousted by plastic replacements. But, unknown to many, these plastics are highly combustible and the major cause of numerous devastating fire losses.

In many of these incidents, the fire exposure from the building construction was greater than the fire hazard associated with the occupancy. It was apparent that the hazard of using plastic materials in building construction was not always identified prior to the loss, or the potential severity quantified, according to a study by industrial and commercial property insurer FM Global.

For several decades now, plastic materials have been replacing brick, wood, steel, concrete and glass in industrial and commercial constructions. Rigid foam polyurethane was first used to provide insulation beneath floor slabs, replacing cork, nearly 50 years ago. There are many benefits in using plastic components as elements of the building envelope, in building services and in fitting out the building for production:

- Plastics have a high strength-to-weight ratio
- do not corrode
- are water resistant
- are easy to clean and maintain
- have high thermal and electrical insulating values
- are easy to fabricate and install.

A major disadvantage, however, is that plastic materials are combustible and, in some forms, can present a severe fire hazard. The level of fire hazard it represents is a function of its heat release rate. As the heat release rate increases, so does the fire hazard. The heat release rate of plastic materials, measured in kW/m^2, can be three to five times greater than a similar arrangement of ordinary combustibles like wood.

THE REAL COST OF PLASTICS

During a recent 10-year period spanning 1988-97, seventy large fire losses from several countries were reported to FM Global in which plastics had been used in the construction and were a significant factor in the loss. The total cost to industry was over £275m.

Inadequate sprinkler protection was an important factor in the size of each of these 70 losses. Either the needed protection was lacking; or there was a shut-valve, or the flow and pressure of the water supply could not meet the sprinkler system design requirements. In 66% of these losses, sprinkler protection was lacking. The average loss for incidents where sprinklers were lacking was £4.4m, compared to £474,000 in incidents where sprinklers were effective.

During this period, 60% of the large losses involving plastic, involved

Are combustible plastics lurking in the construction of your facility?

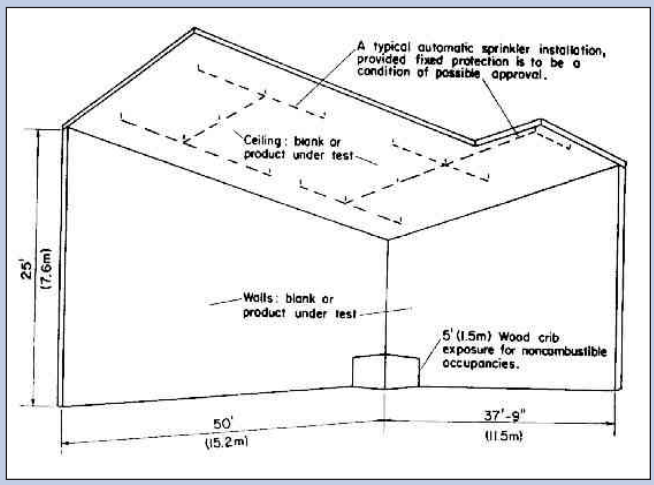


Figure 1: Factory Mutual Research Building Corner Test

exposed foam plastic insulation, and insulated metal panels. In 24 of these losses, polyurethane was involved; 14 losses involved extruded and expanded polystyrene; four involved polyisocyanurate, and in the remaining 10, the type of foam plastic was not identified.

The metal/mineral and food industries saw the largest number of losses (see Table 2). While this industry typically has facilities that contain few combustibles, there is often a hidden fire exposure from the plastic insulation in the walls or roofs of buildings.

The largest number (37%) of these losses where the probable cause was identified were caused by hot work like welding, cutting and use of open flames. The second highest frequency (25%) was electrical causes.

Insulated metal panels for refrigerated storage are often used in the food industry. Even with sprinkler protection, a fire may develop faster than the sprinklers can operate, or the fire could spread into the panel, where the metal liner will shield it from the water.

Fires involving plastics used for production process equipment were analysed in another 10-year study for the same period. Eighty-nine fires, resulting in over £110m in losses, involved plastic ducts/hoods, tanks, and scrubbers.

FULL-SCALE FIRE TESTS

Two factors have contributed to these severe losses: inadequate fire testing and sprinkler protection. Thirty years of research and testing had made FM Global a strong advocate for the use of automatic sprinkler protection. Most of the development work on sprinklers has been to protect a building from fire that starts within the combustibles in the occupancy. However, from the loss experience the question needs to be asked will these sprinkler systems protect the building if the fire starts in the plastic construction?

And while each country has its own traditional fire test to determine the reaction of a material to fire (for example, BS 476 in the UK, DIN 4102 in Germany, NF P92-501 in France, ASTM E84 in the USA), FM Global and a number of other approvals boards have found that the results from these tests are not always indicative of how a plastic material behaves in a real fire.

The limitations of the small-scale traditional fire test were recognised in the early 1970s by an FM Global affiliate, Factory Mutual Research, which developed a large-scale test, the corner test. The objective of the corner test is similar to the room test in LPC standard 1181. This is to ensure a plastic wall or ceiling material does significantly contribute to fire propagation within a building. However no research has been conducted to correlate the test results from these two test methods.

FM Global's corner test evaluates exposed foam plastic materials, rigid plastic liners, and insulated metal panels on walls, as well as ceilings. A plastic material passes the test if a self-propagating fire does not reach the limits of the structure within 15 minutes.

In this test, 340kg of wood is arranged as a 1.5m-high crib, in the corner of the structure, 305mm from each wall – the equivalent of having a 1.5m-high stack of idle wood pallets in the corner of a factory. Temperatures produced by this fire exposure can exceed 550°C at the corner of the walls and ceiling, with flames attacking the ceiling.

FM Global Property Loss Prevention Data Sheets permit a material that passes the test to be used in a building up to 9.1m high. For buildings with higher ceilings, the plastic is tested in a similar test rig but the height is increased to 15.2m.

Many corner fire tests have been conducted at Factory Mutual Research on materials such as glass reinforced polyester sheeting, exposed spray applied polyurethane, polystyrene, polyisocyanurate, and polyurethane insulated metal sandwich panels. This testing showed that sprinklers designed

Table 1: Fires by type of plastic construction (1988–97)

Type of construction*	Number of losses
Foam/exposed/sprayed-on coating	33
Insulated metal panel	19
GRP panels	11
Plastic rooflights	5
Plastic vapour barrier in concealed space	1
Plastic sheet covering walls and equipment	1
Total	**70**

*These do not include plastics that are part of insulated steel deck roof construction

Table 2: Fire losses by probable cause

Probable cause	No. of losses
Hot work	19
Electrical	13
Hot surface	6
Exposure	
Smoking	2
Gas burner flame	1
Miscellaneous spark	2
Spontaneous ignition	1
Incendiarism	2
Friction	2
Unknown/no data	18
Total	**70**

for the occupancy are adequate, but there are exceptions if the product has not been approved by Factory Mutual Research or constructed to FM Global Loss prevention standards. In such cases it is necessary to install additional protection such as cover the wall and ceiling with a thermal barrier.

In one of the most recent research programmes a series of eight 7.6m high corner tests were conducted on polystyrene insulated metal sandwich panels. Prior to this test series the recommendation was to cover these panels with a thermal barrier. The testing results showed that by either increasing the sprinkler system performance, or providing an additional row of sprinklers at the top of the wall, adequate protection can be provided without the need for a thermal barrier.

SMALL-SCALE TESTING

Due, in part, to the expense of large-scale fire testing, scientists at Factory Mutual Research developed a reliable small-scale test for all plastic materials. They developed a test apparatus for evaluating the flammability of materials, the Factory Mutual Research 50kW Scale Fire Propagation Apparatus (FPA) after many years of research.

Initially used purely for research purposes, it has recently been used in Factory Mutual Research's product approvals programme for testing thermoset plastics. The small-scale test results have been correlated with those from the full-scale corner test. Thus a new material or product that satisfies the small-scale flammability test criteria does not have to be subjected to full-scale testing.

The Fire Propagation Apparatus essentially consists of two parts: the bottom portion is designed to recreate large-scale fire environments, through the use of radiant heaters; and a collection hood on top captures combustion products for sample analysis. Measurements in the apparatus are made to determine:

- critical heat flux for ignition
- thermal response parameter
- chemical and convective heats of combustion
- effective heat of gasification.

Are combustible plastics lurking in the construction of your facility?

Table 3: Plastic process equipment number of losses by industry group

Industry group	Ducts/hoods	Tanks	Scrubbers
Metal/mineral	29	22	2
Chemical	5	1	–
Rubber	3	4	–
Food	3	1	1
Pulp and paper	–	–	1
Other	13	2	2
Total	**53**	**30**	**6**

This equipment has become an important tool for future research and the development of property loss prevention standards, particularly for construction materials. The FPA also has been adopted by the American Society for Testing Materials as their standard ASTM E 2058, and also by the National Fire Protection Association as their NFPA 287.

CONCLUSION

It is easy to the laud the many advantages of plastic building components but when weighing their cost benefits it is important to remember their potential fire hazard. Ask if there is a non-combustible alternative before choosing a plastic material.

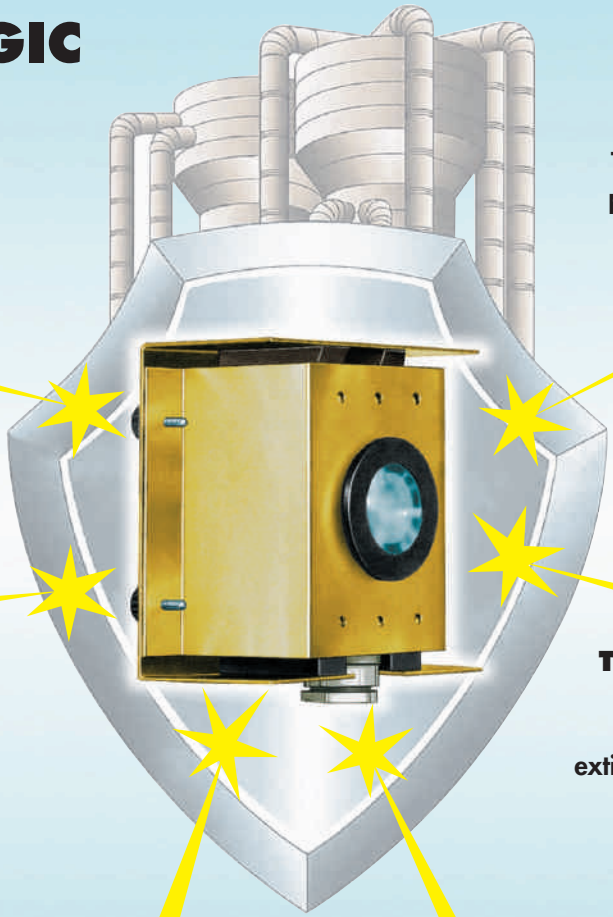
A reliable indication of how a plastic material will behave in a real fire can only be done in a large-scale test or, for a thermoset plastic, in the Factory Mutual Research Flammability Apparatus. Ask for materials that have been Approved by a recognized product certification organisation like Factory Mutual Research when specifying new construction materials, These materials will have undergone stringent performance testing.

Finally, be alert when evaluating the fire risk of existing buildings. There may be more plastics hidden in the construction than you think and the hazard may not be adequately protected.

Further information on FM Global data sheets is available from
www.fmglobal.com/store

CONTROL LOGIC Spark detector

designed for dust collection systems to protect storage silos from the risk of fire.



Sparks fly at high speed.

They travel at a hundred kilometres per hour along the ducts of the dust collection system and reach the silo in less than three seconds

The CONTROL LOGIC SPARK DETECTOR is faster than the sparks themselves. It detects them with its highly sensitive infrared sensor, intercepts and extinguishes them in a flash. It needs no periodic inspection.

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For industrial applications indoors or outdoors where is a risk of explosion and where the explosionproof protection is required.
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EGS Electrical Group NELSON Firestop Products

Nelson Firest

A history of turning seconds into hours, when time means everything

Nelson Firestop is a company uniquely equipped to specify firestopping solutions for each and every penetration throughout the entire building. It is a hard-earned skill that deals with very high stakes. The fact is, a wrongly chosen firestopping product may, to the untrained eye, appear sufficient on most counts. It may even comply with building and fire codes. However, just one incorrect choice, or the right choice improperly installed, can spell the difference between minor damage and total disaster. To deal effectively with the complexity of firestop selection, the best and simplest path is to consult Nelson Firestop Products.

Decades of experience, dedicated to firestopping

Firestopping has been the sole focus at Nelson for nearly four decades. Since 1965, Nelson Firestop Products have been used to offer protection against fire, smoke, water and explosions in military and commercial marine vessels, oil-rigs, production platforms, and more recently, in commercial and industrial buildings. All the while, Nelson has invested heavily in research, development and testing. In 1966, Nelson generated the first test to be recognized by an independent laboratory for through-penetration firestop system for Nelson's MCT™ (Multi-Cable Transit) System.

Helping to increase fire safety throughout the world

Nelson Firestop Products offer the right class of protection for virtually any penetration anywhere in the world. A very extensive product line makes this possible. Perhaps even more importantly, Nelson offers the dedicated service and in-depth knowledge to recommend systems, meet and exceed local requirements, and oversee installation wherever the assignment takes us.

If you want to specify the best firestop solution for any given application in the U.S. or overseas, Nelson is the company for a quick, accurate response. Products you can depend on. People you can depend on. **Nelson makes it easy.**

A wide range of firestop products that do more than stop fire

Nelson offers the industry's largest and most diverse firestop product line. Partly because there are so many types of penetrations to seal, and also because firestopping is a challenge that involves more than just fire.

Any properly designed and constructed fire barrier – whether it's a wall or a floor – must prevent the migration of not just fire, but heat, smoke, water, gases and toxic fumes as well. Similarly, firestop seals installed in these barriers are required to perform the same functions. When a fire breaks out in an occupied building it is smoke, not fire, which poses the bigger threat to its inhabitants. People who perish in fires generally die from smoke inhalation, not burns.

op Products

Nelson's flexibility provides vapor-tight protection

Rigid firestop products can, in some cases, provide adequate protection. However, if the seal is installed in a building subject to a great deal of movement, it may lose its bond and will not afford any protection against the migration of smoke or toxic fumes. That is why the Nelson firestop family contains many flexible formulations. "Soft" firestop material maintains a more reliable seal as buildings shift, or as wall and floor assemblies constructed of dissimilar materials expand at different rates when exposed to the heat of fire.

Solutions for single and multiple penetrations

Nelson Firestop Products accommodate single penetrations, such as pipe and multiple penetrations typically created for power and low-voltage cable. Because today's power and communications needs are subject to great variation and frequent change, Nelson offers innovative designs like Nelson's Multi-Cable Transit (MCT™) and Multi-Plug System (MPS™) which can be easily customized to any installation, and subsequently modified when necessary.

The same Nelson products that were created for the complex power and electronic needs of naval command centres have proven to be ideal for rapidly evolving technologies of commercial and industrial work environments.

Solving the problem of water

Since water is often the means of stopping fire, it might not seem a potential firestopping problem, but it is. Water-soluble firestop seals installed in areas subject to high moisture or frequent spills can dissolve and become totally ineffective. Nelson Firestop Products are made from water-insoluble compounds. Once installed, Nelson products provide long-lasting firestop protection when exposed to mist, spray, spills or even frequent hosedown.

Reducing the hidden costs of installation

The cost of a firestop system is not just what you pay for the products, it also includes the less obvious expense of labor for installation. To keep labor to a minimum, Nelson products are designed for fast, easy installation. You do not need personnel with special skills or tools. You can even forego the extra steps and material associated with damming.

Regardless of what Nelson Firestop Products you use, installation is simple and straightforward, for a lower total installed cost.

The right combination of products for a great number of variables

Building movement and the presence of water are two of many considerations critical to making the right firestop decision. One must also consider the dimensional changes that occur when any substance is placed in or near fire. Walls and floors constructed of concrete will react differently when exposed to heat than those constructed of metal studs and drywall. Some penetrating items will burn; others will be totally non-combustible, but will transfer heat freely. Still, other penetrations will burn at a slower rate, but not support combustion by themselves.

All of these factors and more must be considered when engineering a firestop system. That's why our product line is so extensive and why people come to Nelson as much for our advice, as for our firestop products. We are the company that puts it all together, which means less effort for you, and more peace of mind.

For more information, please contact:
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Fax: +1 918 627 2941
E-mail: info@nelsonfirestop.com
Website: www.nelsonfirestop.com

The RSA FORUM

Automatic Fire Sprinklers as we know them were first developed in the UK by Major Stewart Harrison around 1864. Like so many brilliant inventions it took another country, in this case the USA, to recognise the full potential of the invention and develop a market for them. Since then the USA has gone on to lead the world in the development of fire sprinkler technology and it comes as no surprise that the majority of fire sprinklers are now manufactured over there. Conversely our British Industry has declined to the point that there is now no British manufacturer that actually makes fire sprinklers in the UK.

To my mind it is somewhat of a pity that the UK has fallen so far behind in the use of yet another British invention and one of the reasons for creating the RSA's was to reverse this situation. It is therefore pleasing to see that interest in fire sprinklers has increased remarkably since we started in 1998 – not only in the life safety sector – but we have a long way to go yet!

WALES

Earlier this year the RSA visited Neath & Port Talbot Council to bring them up to speed with residential sprinklers. Neath are very pro-active in the field of fire safety and were the first Council in the UK to adopt smoke alarms in all their social housing. Although smoke alarms have been effective, the Council can see that they cannot save the disabled, the old and the young – the vulnerable in our society who make up the majority of fire casualties. They are therefore keen to be the first in the UK to go to the next stage in fire protection and install fire sprinklers in all their property.

The Welsh Assembly, through its Pattern Book, governs the design of all social housing in Wales. Initially Neath Council applied for a variation to the Pattern Book for a pilot scheme. This led to a request from the Welsh Assembly for the RSA to make a presentation to their Housing Committee to explain the concept of life safety fire sprinklers. Sir George Pigot and Roy Young duly made a presentation in mid-June, which was very well received, and were told unofficially that it was likely that a policy of residential sprinklers would be adopted for all Council-owned social housing in Wales. Since then many other Welsh Councils and the Welsh Fire Brigades have put their weight behind the campaign and we are hopeful that the Welsh Assembly will act soon.

SCOTLAND

Many will have seen that Michael Matheson MSP has prepared a Bill for Scotland's Parliament, which would make the fitting of Residential Sprinklers mandatory in all housing in Scotland – both new and old. The RSA warmly congratulates Mr Matheson on his initiative, especially the fact that the Bill targets the elderly, disabled and HMOs.

Scotland unfortunately has the highest fire casualty rates in the UK, particularly in the tenements that are a feature of the Glasgow area. Although Scotland has about 10% of the UK population it has something like 17% of the UK fire deaths. Statistics show that HMOs (such as the Glasgow tenements) account for nearly 35% of all fire deaths and 40% of all fire injuries and that the majority of those casualties are the elderly or disabled – the vulnerable in our society. There is therefore an urgent need to provide better fire protection in Scotland. Something fire sprinklers are specially designed to do.

There are those who say that Scotland cannot afford the cost of installing fire sprinklers in all residential properties and it is worth looking at this statement for a moment.

Firstly, if we can prevent people being killed or horribly maimed by fire, should we really be counting the cost? How can you explain to someone that the reason their children are dead is because those responsible failed to put in a safety device because they "thought it was too expensive".

Secondly, we know from statistics that certain types of property and certain sections of the population are at increased risk from fire. So where the vulnerable are housed in HMOs, especially those of more than 3 floors in height, they have an unacceptably high risk of being killed or injured in a fire. All of these factors should show us that it is these properties that we should protect first. Once these properties have been protected a longer-term phased schedule can be set up to provide sprinkler protection to properties at lesser risk, which in time will mean all properties will be protected.

ENGLAND

So what progress is being made in England? So far the RSA is only aware of a few hundred residential sprinkler installations, although it is believed that there is in fact many more as yet unreported. However, against a housing stock of about 20million this is hardly impressive – but it is still early days. . . .

Most of the English Fire Brigades and many local Councils are now specifying residential sprinklers, especially in higher risk premises. Even builders and architects are expressing interest and beginning to look at residential sprinklers not just as a cost, but also as a saving. This is especially true of Housing Associations, which have been quick to see the benefits to both themselves and their tenants.

Interest is such that the House of Commons all-party Fire Safety Group is holding a seminar in the House on December 12th at which the RSA have been invited to speak. We also hope to perform a demonstration of the effectiveness of fire sprinklers in the forecourt of the House of Commons. We have no doubts that MPs will be impressed by what they see, but if it *does* go wrong – perhaps we can finish off what Guy Fawkes began all those years ago. . . .

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The Development of Residential Fire Sprinklers

By Sir George Pigot of the Residential Sprinkler Association

Pic: Residential Sprinkler Association

***FIRE SPRINKLERS** were invented in the UK by Major Harrison in 1864, but like so many of the brilliant things invented in this country, they were left to be developed abroad by Henry Parmelee in the USA.*

The Insurance Companies soon recognized their advantages, and within a short time began to insist on the installation of fire sprinkler systems in areas of high risk. Thus began a long association between Insurers and the Sprinkler Industry. As a result fire sprinklers were developed primarily to protect property and their life saving abilities were largely ignored until comparatively recently.

The record of fire sprinklers is unsurpassed in the safety field. In New Zealand, where all fires have had to be reported for over 100 years, records show that sprinklers have been effective in 99.7% of cases. There has never been a multiple death in a fully sprinklered building anywhere in the world. Indeed in the very few cases where people have died despite there being an operational fire sprinkler system, it has been because of an explosion or similar event.

Fire sprinklers have been continuously developed throughout their history and the modern residential fire sprinkler is a highly sophisticated piece of equipment. Its development started as a result of a report prepared in the United States by the Presidential Commission on Fire Prevention & Control entitled America Burning. This report, published in 1973, highlighted the scale of the fire problem in the United States and in particular drew attention to the fact that over 75% of all fire deaths and injuries occurred in the home (a statistic which is equally true here in the UK). They recommended the development of a residential fire sprinkler system as a possible solution and this prompted the NFPA to set about developing a modification of its Standard, NFPA 13 Standard for the Installation of Sprinkler Systems, to produce a reliable but inexpensive residential system.

At its first meeting the NFPA established a philosophy based on the following 5 guiding principles:-

1 COST is of major importance. They reasoned that a system that was slightly less sophisticated, but that could be installed at a substantially lower cost than a full NPFA 13 system, was necessary if wide-spread acceptance of residential systems was to be achieved.

2 LIFE SAFETY is the primary goal of a residential fire sprinkler system, with property protection a secondary goal.

3 SYSTEM DESIGN should be such that a fire could be controlled for sufficient time to enable people to escape, i.e. it should operate for at least 10 minutes whilst sounding an alarm.

The Development of Residential Fire Sprinklers

Residential sprinklers can be supplied in almost any colour or finish and there are now heads which are concealed behind a temperature sensitive plate, and which are therefore almost invisible and virtually immune to tampering or vandalism.

4 **PIPING** arrangements, components, and hangers must be compatible with residential construction techniques.

5 **STRATEGIC COVERAGE** allowing the omission of sprinklers in areas of low historical incidence of fire deaths (such as roof spaces and the like) was permissible, thus saving considerable cost.

Considerable experimental work was carried out in the 1970's and early 1980's to establish the most effective spray patterns, droplet sizes and flow rates for residential sprinkler heads. It had long been recognised that a faster response to a fire would mean that the sprinkler system would be dealing with a smaller fire. A smaller fire is not only easier to control and extinguish, it requires considerably less water to do so. Therefore a major part of this work was to also develop a faster acting sprinkler and modern residential heads operate at least five times faster than their industrial counterparts.

It was also established that wall wetting would be of vital importance to prevent "flashover". Flashover is the point at which the temperature in the room has risen to the point that anything not already alight will spontaneously ignite. This not only uses up all the remaining oxygen, it also raises the temperature in the room well past a survivable level. Flashover in an unprotected modern living room usually occurs within 2-3 minutes of the first flames being visible.

In the 15-20 years since these experiments were conducted sprinkler manufacturers have continued to develop residential sprinkler heads, which are ever more economical in their use of water to achieve the same result, and which are also more aesthetically pleasing. Indeed residential sprinklers can be supplied in almost any colour or finish and there are now heads which are concealed behind a temperature sensitive plate, and which are therefore almost invisible and virtually immune to tampering or vandalism.

So effective are residential sprinklers that over the past 25 years many areas of the USA have introduced laws requiring their installation. In general all high-rise building must be sprinklered and it is very unusual to find places such as hotels that are not fully protected by sprinklers. The US Government is fully supportive of fire sprinklers and insists that, where Government employees need to stay away from home overnight they must stay in sprinklered hotels or they will not have their expenses reimbursed. So successful has this been that the Marriott hotel chain amongst others has now sprinkler protected all it hotels worldwide to ensure they can cater for US Government officials traveling abroad.

Pic: Residential Sprinkler Association

Several parts of the USA have even gone further and now require sprinklers in ALL properties both residential and industrial. Perhaps the best known is in Scottsdale, Arizona, which has now had this requirement for over 10 years. During this time there have been no deaths in sprinklered homes, both injuries and property damage has been reduced by 80% and environmental damaged reduced by an estimated 95%. Vancouver in western Canada adopted a similar policy in the early 1990s and their recent interim report shows much the same picture.

In the mid-1980s the US Fire Administration joined forces with the NFPA and others to form **Operation Life Safety** with the object of further promoting residential fire safety. OLS has collected some 600 voluntary reports on residential sprinkler activations since 1983 and in none of these was there a fatality. Residential fire sprinklers really do save lives.

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The Development of Residential Fire Sprinklers

Pic: Residential Sprinkler Association

Not only do sprinkler systems provide a very high level of protection there are a number of areas in which their cost of installation can be directly mitigated.

- Building trade-offs. The requirements for and specifications of fire doors and fire retardant materials can be reduced. Also the length and number of escape routes can be reduced and provision for access by fire engines lessened allowing higher housing densities to be employed.
- Arson. Arson now accounts for about 50% of all dwelling fires and this proportion has increased steadily over the past decade or more. Although fire sprinklers cannot prevent arson as such, they will minimise the damage caused and eliminate the risk to life.
- Vandalism. Vandalism is a growing problem and is manifested both in terms of direct damage done as well as potential damage when safety equipment is made inoperative.

- **Insurance.** Although there is no general policy insurance companies will give discounts for sprinklered properties, which is typically around 15% of the building and contents premium.
- **Rates.** The RSA would argue that the fitting of sprinklers reduces that property's liability for local emergency services and as such should be recognised and encouraged by a rebate of Rates.

There are other less obvious benefits for fire sprinklers, which are usually only appreciated after a fire.

- **Consequential Loss and Inconvenience.** Buildings that sustain a fire are usually uninhabitable afterwards and most are demolished. On the other hand a room protected by a fire sprinkler can usually be back in use within a few hours and the rest of the building is often unaffected.
- **Loss of Income and Cost of Re-housing.** A direct result of this is that landlords and mortgage companies do not experience a reduction in income and there are no costs of re-housing. Where property is demolished and rebuilt the landlord will be without income for many months at a time of major expenditure.
- **Demand on the Fire Service.** Where fire sprinklers are fitted Fire Brigades need employ fewer resources in fighting the fire and know that their men will be less likely to suffer injury.
- **National Health Service.** By reducing injuries to both victims and fire fighters the cost to the National Health will be considerably reduced. In 1997 18,600 people required an average of 4 days in-patient treatment and considerable convalescence afterwards. Which leads to:
- **Social Services.** Fire injuries are probably the most difficult to treat and result in the longest time off work – if indeed a return is possible. Although external burns are the most obvious injuries it is lung damage from hot smoke and fumes which is often the most incapacitating injury and which may well prevent a return to work ever being possible.

It is a sobering thought *that in 1997 72,000 people in the UK thought that their home wouldn't catch fire – but each and every one of them had to call the Fire Brigade. In total 730 people lost their lives and another 18,600 were injured due to fire.*

The time has come for the UK to recognize the significant contribution Fire Sprinklers can make to life safety and begin to catch up with the rest of the world. How much longer do we need to wait before we start to eliminate the terrible toll fire wreaks in our society?

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Detectors Raise the Alarm for Special Hazards

THE FIRST STEP in extinguishing a fire is detecting fire. The faster the detection, the faster the fire can be put out – with less damage. Special hazards applications use four types of detectors – smoke, heat, flame and gas detectors.

By Mitch Lebovic, CAE

SMOKE DETECTION

The most commonly used detectors are smoke detectors. These range from conventional spot detectors to state-of-the-art air sampling detectors that are up to 1,000 times more sensitive than their conventional counterparts.

The two technologies used in smoke detection are photoelectric and ionization. Ionization smoke detectors operate using a small radioactive element inside an open smoke chamber. The radioactive element ionizes the air inside of the chamber, causing ions to gravitate toward oppositely charged plates at each end of the chamber. When a quantity of smoke enters the chamber, the conductive properties of the air change, reducing the number of ions that are able to reach the charged plates. When the supervisory current reaches a certain level, the detector goes into alarm.

Ionization detectors work particularly well in situations where fast flaming fires might develop. Their photoelectric counterparts are better at detecting smoldering fires. Photoelectric detectors use light rather than radioactive material to detect smoke. An infrared light source on one end of the chamber travels along a narrow channel. As long as there is no smoke inside the chamber to diffuse the light, a photocell at the other end of another channel, situated at an angle from the light path, will remain dark. When enough smoke enters the chamber, the infrared light, which is then diffused, scatters and travels down the alternate channel until it reaches the photocell at the other end. The detector will go into alarm when enough of the light is made to strike the sensor. Some smoke detectors combine both photoelectric and ionization technology. Some feature thermal detection technology as well. All of these detectors are available in conventional and addressable models.

Pic: Fire Suppression Systems Association

Detectors Raise the Alarm for Special Hazards

"Conventional detectors are not automatically adjustable," says George Krabbe, chairman of the board of Automatic Fire Controls in South Holland, Ill. "Their sensitivity is set at a certain level and stays there. Addressable detectors can be adjusted by the control panel to limit false alarms."

"Another advantage of addressable detectors is that the control panel can tell you which detector went into alarm," he continues. "With conventional detectors, you'll know which zone goes into alarm, but you can't tell which detector until you physically look at them. With addressable detectors, the panel will tell you it was number 25, which is located in the computer room sub-floor. There is a lot more information which allows the operator to respond quickly and intelligently." Laser spot detectors provide more sensitive smoke detection.

"The laser detectors work on the same principle as the photoelectric devices," says Bill MacDonald, director of marketing for Notifier, Inc. in Northford, Conn. "They are light sensitive, but the light source is a laser diode rather than a light emitting diode. Because the light source is much more intense, the receiver is a lot more sensitive."

MacDonald continues to say that laser detectors work in conjunction with very sophisticated algorithms to prevent false alarms. These highly sensitive detectors can tell the difference between dust and smoke.

For applications that require detecting smoke at its earliest stage, air sampling is the answer. Instead of passively detecting smoke or heat in their immediate area, air-sampling detectors actively pull room air through and detect the presence of particles that are created in the very early stages of combustion. "The big advantage of air sampling is that the unit has a fan," says Krabbe. "It doesn't need a thermal lift to bring the smoke to the detector. Air sampling draws in air constantly, samples it and returns it."

Pic: Fire Suppression Systems Association

Air sampling detectors can detect particles of combustion at levels of obscuration as low as .003 percent per foot, which is up to 1,000 times more sensitive than conventional smoke detectors. However, they lack the pinpoint annunciation of an addressable spot detector. They operate by using a series of pipes up to 100 feet long. The pipes have holes in them at predetermined intervals. The fan draws air in through the holes and back to the detector. Some detectors can tell the control panel, which pipe the smoke, comes from, but not which hole in the pipe. "The extreme sensitivity of laser air sampling units allows them to overcome dilution caused by high air flow," adds MacDonald.

"They are typically used where critical equipment is involved like telecommunications or computer technology. This equipment is more susceptible to smoke than normal equipment. Smoke is also much harder to detect because of the high airflow generated to cool the equipment. That's when very early warning is important."

Krabbe suggests that this extreme sensitivity can save not only time, but also money when it comes to extinguishing a fire.

"We don't often use air sampling detection to release the agent," he says. "Because these detectors are so sensitive, they'll detect smoke at a point where turning off a switch or using a portable extinguisher can solve the problem. If that's the case, you don't want to dump $30,000 worth of agent." Air sampling is also a more expensive technology. "A laser air sampling detector will cost between $3,000 and $4,000 whereas spot detectors will cost between $20 and $60," says Krabbe. "But each air sampling unit can take the place of 20 to 30 spot detectors because of the piping network."

THERMAL DETECTION

Thermal or heat detectors monitor the temperature of the air surrounding the unit. Fixed temperature detectors signal the controller when the temperature reaches a preset level. Rate-of-rise detectors look for rapid increases in temperature and report them to the controlling unit. Both methods are sometimes combined in one unit.

Linear heat detection is also used in many industrial applications. A linear heat detector is a wire made up of two

"The big advantage of air sampling is that the unit has a fan. It doesn't need a thermal lift to bring the smoke to the detector. Air sampling draws in air constantly, samples it and returns it."

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Detectors Raise the Alarm for Special Hazards

conductors, each coated with a heat sensitive material. When the temperature reaches the level at which the insulation was designed to melt, the conductors push through the insulation and close the circuit. "Linear heat detectors also have the ability to tell you how many feet down the wire the overheat has taken place," says MacDonald. "The big applications for this type of detection are high rack storage, conveyor systems and cable protection."

FLAME DETECTION

Industries involved in manufacturing, processing, storing or transportation of flammable material are constantly in need of reliable and fast response fire detection systems. Optical flame detectors are powerful tools in this case, due to their ability of remote detection of a small fire from a long distance. Flame detectors use optical sensors working at specific spectral ranges that record incoming radiation at selected wavelengths. They use either ultraviolet sensors, infrared sensors or a combination of both to achieve this purpose.

"Optical detection can be limited because it's line of sight," warns Krabbe. "You have to make sure you're in an area where you're not going to have a smoldering type of fire with a lot of smoke. That will obscure the fire from the detector. You also don't want anything to stick to the lens of the detector. You must make sure that the cone of vision from the detector is not obscured in any way."

GAS DETECTION

Gas detectors can also be integrated into a special hazards suppression system. These detectors continuously monitor hazardous and toxic gases or vapors in low parts per million concentrations. They are highly sensitive, so low ppm readings can be measured with confidence. They provide a fast response for real time readings.

THE RIGHT CHOICE

The right choice in detection technology depends largely upon the hazard to be protected. "You need to be sure you're putting in the right detector for the application," says MacDonald. "You need to be sensitive to potential false alarm sources. For example, you wouldn't want to put an ionization detector near cooking, and you don't want traditional smoke detectors in places where there is a lot of dust."

"Consider the environment," agrees Krabbe. "You won't want smoke detectors in harsh environments. If the environment is cold, a build-up of ice and moisture will cause the detector to go into alarm. In that situation, you'd probably want a thermal detector."

Pic: Fire Suppression Systems Association

Krabbe continues to say that the necessary response time is a factor in choosing the proper detection solution. "If detection can wait a minute or two, you can go with thermal detectors," he says. "But if it needs to be immediate, you need to go to the other extreme. If I had a clean room worth millions of dollars where a few specks of combustion products could put me out of business, then I'd certainly invest in sensitive smoke detection."

PROPER INSTALLATION

The installation of detection units will vary by application. However, proper installation is always guided by appropriate standards. In the United States, the National Fire Protection Association's Standard 72, the National Fire Alarm Code, should be used for guidance. In Europe, ISO 7240 covers fire detection and alarm systems.

"Make sure to check for other requirements from local authorities having jurisdiction or insurance companies," says Krabbe. "They may have some specific requirements on how detectors are sequenced, how they are grouped or how they are selected. That is important along with the regular standards."

"Consider the environment. You won't want smoke detectors in harsh environments. If the environment is cold, a build-up of ice and moisture will cause the detector to go into alarm. In that situation, you'd probably want a thermal detector."

Mitch Lebovic, CAE is director of communications for the Fire Suppression Systems Association. You can learn more about FSSA and its programs online at www.fssa.net.

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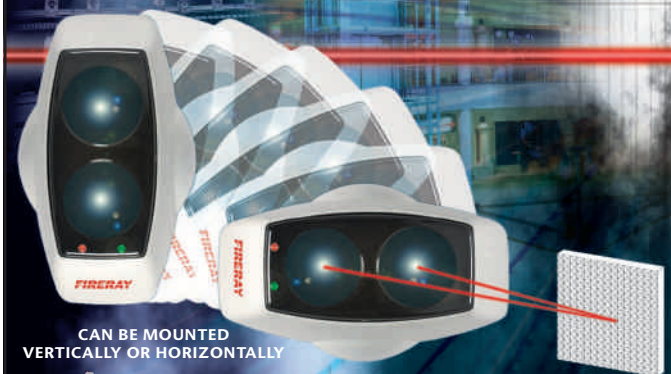

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The Wirsbo Fire Protection System, Europe's most technologically advanced domestic sprinkler system, has been devised for new-build applications. Until now, the costs associated with such systems have been prohibitive for suppliers and customers alike. Unlike commercial specifiers, the average householder has rarely been able to justify the purchase in terms of reduced insurance premiums. Cost-effective, fire engineered solutions can now be achieved to meet current building regulations.

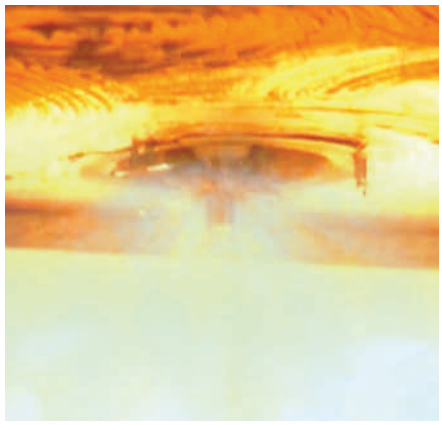
The Wirsbo Fire Protection System, with integrated audible alarm, is designed to contain a fire in the room of origin for up to 10 minutes to allow time for the Fire Service to arrive.

Key to the system is the incorporation of Wirsbo's PEX pipe, a revolutionary cross-linked polyethylene tubing with thermal memory. Irrefutably reliable (Wirsbo PEX is the most thoroughly tested plastic piping in the world), the flexible tubing is easy to install. Plumbers already favour its properties for under-floor and radiator heating systems. However, it is ideal for the new-build sprinkler market, where ease of installation is of prime concern to the house builder in terms of time, price and minimal disruption.

Wirsbo PEX is already used extensively in domestic sprinkler systems in the US. Conforming to NFPA13D, it is the benchmark for worldwide domestic sprinkler systems with full WRAS approval. The UL listed Wirsbo tubing also carries a 25 year guarantee.

There are environmental and legislative reasons for taking notice of the system, too. Current sprinkler systems may rely on segregated water which stagnates over time and is potentially harmful. This integrated system utilises environmentally-conscious flow-through technology, dependent upon a revolutionary multi-port sprinkler fitting. This ensures the water feeding the sprinkler heads is constantly of drinking quality, putting it leagues ahead of the competition and in line with water supply regulations due to be enforced in 2002.

Several UK projects are already underway. In Lancaster, developers Barnfield Construction have commissioned Homesafe to install the integrated fire defence system in 18 new-build homes. The four storey dwellings, designed with open-plan staircases, have met with planning approval due to the incorporation of this unique fire engineered solution.



In Cowie, Stirling, Homesafe installed the pioneering system into a local authority house, to demonstrate the unique properties of the freshwater system. The council then arranged for a live fire test, which took place earlier this year, amply demonstrating its reliability.

The system was showcased at the Ideal Home Show in Glasgow last month, where visitors to the main exhibition house were invited to find the unobtrusive sprinkler heads.

Wherever the Wirsbo Fire Protection System is placed, householders may be confident that each installed solution has been hydraulically engineered and designed. The number of sprinkler heads required varies according to the specific size and layout of the property.

The system also incorporates the patented Homesafe Alarm. This sounds prior to, but without delaying, sprinkler activation, ensuring occupants are alerted to a fire hazard as soon as possible. High quality approved components from Espa UK and Tyco also ensure system reliability.

Homesafe founder Bill Butler is talking to academic institutions and professional trade bodies to promote best practice within the industry. Hand in hand with his endeavours for the Wirsbo Fire Protection System to do well is his determination that the industry gets it right.

To date, there have been **no** fire-related deaths worldwide in any dwelling with working **sprinklers** installed.

For further information on any aspect of the Wirsbo Fire Protection System, please contact Homesafe on telephone number ++44 (0)1706 831007, fax ++44 (0)1706 222315, or email us at info@homesafesprinklers.com.

CHANGES FOR BUILDING HARDWARE

Testing and Certification for Building Hardware

New test methods and product standards have been developed to European legislation and products will be required to meet the designated minimum level of performance in order to carry the CE mark. This article addresses these issues with respect to building hardware. **CHRIS MILES** gives an overview of the product characterisation tests required to satisfy the essential requirements of the Construction Products Directive (CPD), and looks at aspects of attestation of conformity with respect to CE marking of building hardware.

Characterization Tests to satisfy the Essential Requirements of the CPD

The aim of the CPD is to set up a Harmonised European market for construction products. In order for this to be achieved, it has been necessary to develop a unique system of testing and classifying products for their performance in everyday use as well as in fire situations. The testing and approval system is intended to satisfy the wider European need, to remove technical barriers to trade within Europe. Under the auspices of the CPD, the European Commission issued mandates to initiate the development of European Technical Specifications detailing the minimum essential Health & Safety requirements for products.

In many cases, the mandatory requirements for complying with the requirements are some time off, however, for Building Hardware, we are within months of seeing the first products on the market with all of the requirements met and with products appropriately marked. For Building Hardware, the importance of the essential requirements is only really highlighted when the items are used in connection with a fire scenario, be it a fire resisting doorset or an escape door in the case of a fire. For example, is it really that critical that the door closer works adequately on a non-fire resisting doorset? The main purpose of the non-fire doorset is generally for provision of privacy and that is not a consideration under any essential requirement. However, once an item of building hardware is used in conjunction with a fire resisting doorset the importance of the doorset as a whole, including the item of hardware, is raised significantly. The result is that the second essential requirement under the CPD, Safety in the Case of Fire, needs to be addressed. This is also true of items of hardware that are fitted to doorsets used as final exit doors for the purpose of escape in the event of a fire as these serve an essential function of safety in the case of a fire. All this means that the requirements written within the relevant product standards will have to be complied with in order for the product to be placed on the European market should the item of hardware require to be used on a fire door or a fire escape door.

The process for attesting conformity of the products is becoming clearer to the industry as the relevant bodies begin discussions with the trade associations and individual manufacturers. It is clear that greater emphasis is placed on the 'product' as a consequence of the development of the Product Standards. It is from the requirements within the product standards, which have interpreted the mandates in an Annex (Annex Z), that the need for the testing is determined. They will vary from product group to product group but are generally similar for most critical elements of Building Hardware such as hinges, closers, exit devices etc. The type of tests required on each product will also be dictated by the intended end use for that product.

Within the new, harmonised, system, there was a need to provide identical test methods across the whole of Europe and move away from different National test methods. In doing so, there are inevitably some changes to

test regimes previously used in the UK. Many of the major changes in the testing regime for fire resistance have already been well documented in advance of the change from BS 476: Part 20, to BS EN 1363-1. It is now accepted that conducting European fire resistance tests will provide a basis for mutual acceptance of test results from all laboratories across Europe. This has to be a big advantage to any manufacturer that currently sells across National boundaries within Europe. However, the need to provide for commonality between test methods has resulted in some changes, which, in some countries, may have a detrimental effect on the performance of some products. One area of particular concern for building hardware is timber-based doorsets. The changes in the test methods are likely to affect timber materials and products, which can be exploited by a higher furnace pressure, more so than other products. This is particularly true when elements of metal are placed in the susceptible areas such as the leaf or frame edge.

PRODUCT STANDARDS

A completely new aspect of the European system is the existence of "harmonised" product standards. In order to provide a consistent approach to the attestation of conformity for the hundreds of products sold within Europe, product standards were developed which give the characteristics and requirements for each product type. These harmonised product standards will also, in their Annex Z, give the level of attestation for a particular use.

As a result of the numerous variations within each product standard, space does not allow each requirement for each type of product to be listed here. However, typical and common requirements taken from the documents are listed as examples.

Particular scenarios for mechanical testing of Building Hardware, in addition to any fire test requirements are:

- Certain design requirements
- Corrosion resistance
- Performance requirements such as:
  - release forces and abuse resistance for exit devices
  - efficiency, temperature dependency for door closers
  - static load and endurance for hinges.

The above list is definitely not exhaustive and will include other more product specific requirements once the product standards are looked at in more detail.

Pic: Warrington Fire Research Group

The above tests will provide a classification code, which will contain a minimum of 6 digits signifying each of the different aspects. An example is shown below:

3	7	6	1	1	3

This classification code will vary in the numbers of boxes, and consequently in the number of digits, from product type to product type. Aside from the whole aspect of issuing classifications, which make it easier to translate a code produced in UK into Germany for instance, the code is important for a number of reasons. Firstly, it enables the user to easily identify the products that are suited to the performance of the doorset. This is true for all the hardware items being used on the doorset. Therefore, it also enables a whole suite of products to be used, which are compatible, for instance, there is no point using a closer which is suitable for 200,000 cycles if the hinge will cease working after 50,000 cycles. Additionally, the code identifies the ability of the item to be used on a fire-resisting door. This is provided by the 4th digit, which can be a 0 or a 1, the latter designating that the "intended use" may be on a fire resisting doorset.

Pic: Warrington Fire Research Group

FIRE TESTING

There is currently no European wide small scale test method for evaluating hardware when they are to be used on fire resisting doorsets which means that all type tests will have to be conducted as part of a full scale fire test specimen. There is a draft small-scale method under development but there is as yet no anticipated date for formal consultation to be started let alone for a draft to be available for public comment. This means that the scope of the hardware will be determined by the fire tests that are conducted on the actual elements of hardware. For example, if the item of hardware was fire tested on a steel doorset, it is probably not appropriate to fit it onto a timber doorset or vice versa. The examples that could be used are endless but it is important to remember that the document that is provided at the end of the process may, and probably will, be used across many countries within Europe. Therefore, it is essential that the same system for interpreting the test evidence is also used to ensure acceptability across National boundaries. This means that the scope of acceptability of the hardware will need to be closely 'policed' so that its appropriateness to particular doorsets is clear. This area is still in need of some development by sector groups under the EU 'umbrella' but what is clear is that the scope of applicability will be controlled by a third party and not by the manufacturer as currently happens for the majority of products in the UK. This is

as a result of the importance of the fire aspects of the doorset. The Annex Z of the product standards gives clear instruction that building hardware used on fire resisting or fire escape doors is system 1 attestation and as such there will be an implicit need for the whole operation to be overseen by a certification body, such as Warrington Certification Limited. If the hardware has no intended use on a fire resisting doorset or an escape door then it will be outside the scope of the Mandate, and consequently compliance with any product standards will remain voluntary.

NOTIFIED BODIES

It is clear then, that the method of proof of compliance – that is, the level of attestation of conformity – with the requirements of the European technical specification will be high. Fire doors and associated hardware, having been designated a System 1 level of attestation, have the highest level required for any of the product groups. What does this mean in practice? Essentially it means that these products will have to be the subject of independent third party certification provided by bodies such as Warrington Certification who are 'notified' or 'designated' for the purpose. Testing and classification procedures are aspects of attestation of conformity that are the responsibility of Notified Bodies. These include test laboratories, certification bodies and inspection bodies, which have been notified by the Member State to the Commission. Notification is the process whereby a member state recognises an approval body's capabilities and credentials to perform various tasks as part of the attestation process and 'notifies' the European Commission to that effect. The Group of Notified Bodies was established to ensure mutual confidence and transparency of information relating to attestation of conformity across the Community.

THE PROCESS OF CERTIFICATION

The two main elements of certification are initial type testing and factory production control. Within this there are tasks defined for the manufacturer and the certification body.

The manufacturer is required to operate the factory production control system and to conduct appropriate sample testing as part of the quality plan.

The certification body is responsible for conducting initial type tests on the product, for conducting an initial inspection of the factory and of the factory production control, and also for continuous surveillance, assessment and approval of factory production control.

Pic: Warrington Fire Research Group

All aspects of the performance and manufacture have to be verified by the notified certification body, before the product can legally be placed on the market.

Although the factory production control system does not have to be to ISO 9000, for those companies who have it there should be few surprises except that the factory production control will need to be more product-orientated and address more specifically those parameters, which will affect performance of the product.

The most significant change under the CPD is that for fire doors and fire escape doors at the System 1 level of attestation is that the certification body is obliged to take responsibility for verifying compliance with all Essential Requirements. For building hardware, it will be necessary to conduct initial type tests for mechanical and fire requirements and to provide certification from those tests. Warrington Fire Research Group are in the ideal position to assist manufacturers in obtaining the CE mark as within the WFR Group, Warrington APT and Warrington Certification are leaders in the field of hardware testing and certification. To assist manufacturers further Warrington Certification have recently launched the ACE Programme which will 'hold the manufacturer's hand' through the whole process, automatically informing them of the steps necessary to be able to CE mark on the appropriate dates.

A manufacturer, having satisfied the certification body that his product conforms to the requirements of the product standard, is then able to affix the CE mark to his product. There are, inevitably, rules governing the use of the mark but essentially the mark means it can be legally placed on the European market and the accompanying documentation will specify the performance, the field of application and any limitations on use. It is important to reflect on the status of the CE mark and its limitations. It is not a quality mark. It simply shows that a product has met the minimum requirements established for it, and that it is deemed fit to be placed on the European market and complies with the minimum regulatory requirements of Member States. Although four Member States, including the UK, have declared that they will not make CE marking for construction products mandatory. *However,* this is largely academic since there still remains an obligation on manufacturers to comply with the requirements of the CPD and of course the logical and simplest way to do that is to comply with the requirements for, and to apply the CE mark! That aside it is considered that manufacturers will find that the market will demand CE marking. Certainly products manufactured in States requiring CE marking will be so marked and thus may be expected to have the edge over products without the mark.

The good news for a significant number of UK building hardware manufacturers, who have subscribed on a voluntary basis to third party product certification such as CERTIFIRE, is that they will be in a position to apply the CE Mark as soon as the product standards become available.

Fire-Resistant Glazing for Building Facades

By Mike Wood of PILKINGTON, Germany

Pic: PILKINGTON

Regulations

GLASS IS, OF COURSE, an automatic choice for building facades. We use it primarily to let light in and to give us a view on the outside world whilst keeping the weather out. Glass is used because of the dramatic visual effects it can give to a building, frequently a distinctive stylish signature or an eye-catching aesthetic impact. Further benefits are to limit heat loss, to maximise overall heat gain in winter or to control solar heating and the sun's glare at times of high solar intensity. We might also think about acoustic insulation or security against break in. Rarely does fire protection come first to mind. And yet there isn't one of us who hasn't considered the potentially horrific effects of fire in our high density, high rise urban centres.

The need for fire-resistant glass in facades is well recognised in national regulations around the world, to varying degrees depending on fire history. The most pertinent example of this is Japan, where the almost total destruction of a city in the prefecture of Akita in 1978 led the authorities to focus on stopping fire spread from one building to another. The high premium on space in Japan and the closeness of buildings means that there is widespread use of fire-resistant glass in facades. A similar danger is recognised across both Europe and the USA, where the focus is on providing protected access and exit ways and limiting fire movement along the outside within the building of fire origin, as well as preventing fire spread from building to building.

Common applications for fire-resistant glass in facades are, for example, where two buildings are close together (eg 3m apart), either side of an internal re-entrant corner to prevent fire jumping across the corner, where glazing adjoins an external escape route (eg along a flat roof or by the side of an escape ladder), where the building adjoins a pedestrian pathway at ground level, and on adjacent floor levels to prevent fire movement up the facade by progressive fire break out and break in through the glazing. Whether the glazing remains intact or not can be a dominant fcator determining the rate of fire spread and the fierceness of the fire, determined by the supply of fresh oxygen or not.

Demands on Fire-Resistant Glass Facades

However, fire-resistant glass facades are not straightforward, and there are some special demands. Most importantly, the fire-resistant glass must be installed in an appropriate fire rated external framing system. It isn't a question of just using an internal system. Most certainly not. The framing system must be especially designed with the requirements of external glazing in mind, of course tightness against rainwater. This means paying attention to the normal requirements for external frames in addition to fire performance, most importantly that the frame should be drained and ventilated against condensation. Other design parameters, such as wind, or snow, loading may also be important. Compared to internal systems, the number of approved external systems are far fewer and the choice more limited. The installation must also be installed only by specialist facade system or glazing companies who can demonstrate the necessary experience. The overall glazing specification also has to be taken account of – and there are a number of multifunctional combinations that may be required, to be integrated within the glazing without impairing its fire resistant function.

It isn't just the individual glazing

Pic: PILKINGTON

element that has to be considered either. The whole facade is a major linked construction. The fire-resistant glazed facade therefore has to take into account expansion allowances and the mechanical stability of long runs of vertical and horizontal metal framing members under prospective fire conditions. The weight of the facade elements and structural loadings may also be important. The linkage between individual fire-resistant modules has to be considered, particularly with regard to fire stopping, and there is also the question of flat or inclined glazed roofs to be decided, which may require special fire tests to be carried out. The provision of fire-resistant glazing facades therefore becomes more of an engineering question than is the case for internal fire-resistant partitions and doors.

Testing

The standard fire tests carried out according to national standards do not test whole facade systems. The scale required is too large and the cost too high for routine tests. Yet, how can we check that the extrapolation from single glazed element tests to the whole facade system is predictable, safe and reliable? PILKINGTON has taken the opportunity to carry out a large scale fire simulation trial on a rig developed at the former LPC laboratory in Borehamwood, UK. No other system or manufacturer was tested. The LPC had carried out a programme of 19 tests on standard non-fire resistant glass facades in response to a major concern from insurance companies on the rising costs of property damage, due to both fire and associated water damage. These tests highlighted the curtainwall as a point of weakness. The results showed that standard annealed glass in insulating glass units cracked within 6 to 13 minutes of ignition of the test fire. They also showed that toughened glass, for example in spandrel panels, shattered explosively. The effects in terms of fire breakout were dramatic.

Full Scale Facade Test

At the end of the LPC programme, PILKINGTON sponsored a test on a commercially available fire-resistant facade system.

The test rig was 7.4m high by 6m wide, simulating two floors of a building with two rooms, one above the other, each sized 6m x 4m x 3.3m high. The rig was totally glazed along the front face, installed in the same way as it would be on a real building. The test glazing included PILKINGTON Pyrodur as the inner panel of a double glazed unit, with an

Pic: PILKINGTON

Fire-Resistant Glazing for Building Facades

outer panel of standard float glass. Fire-rated toughened spandrels were installed in the non-vision areas. Individual pane sizes were 1.8m by 1.5m.

The fire was lit in the centre of the bottom floor, using a timber and plastic crib of calorific value of 15MJ/kg to give a relatively steady heat release rate of 3MW. This was specifically chosen to reproducibly simulate the possible fire load in a typical office environment. Fire plume temperatures quickly rose to 800°C in three minutes, providing a high element of thermal shock right at the start, reaching a peak of 900°C after 35 minutes. The test was allowed to run for as long as it took the fire to burn itself out, around 45 minutes.

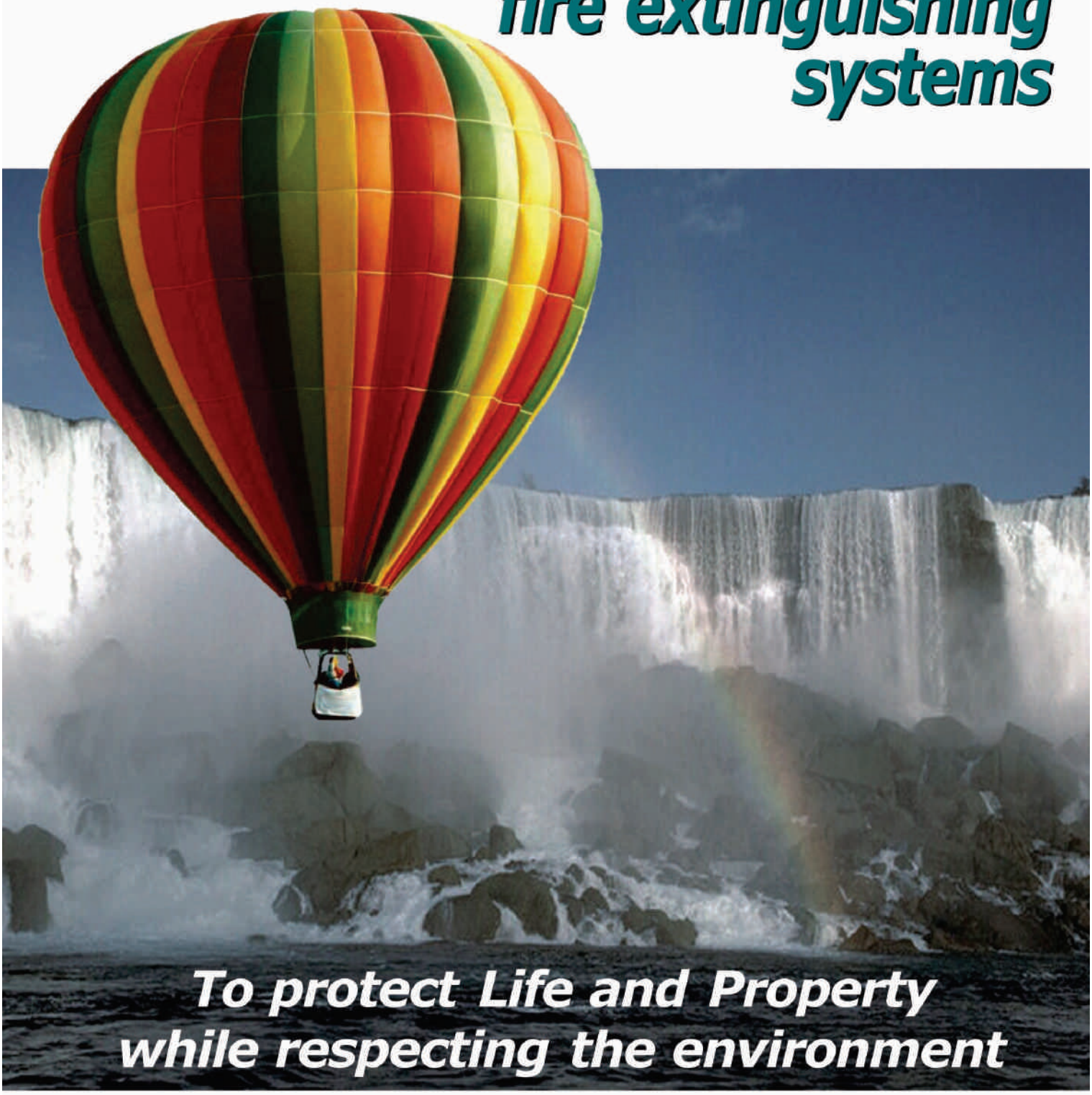
Within five minutes of ignition, the intumescent interlayer of the glazing in the fire chamber started to foam at a temperature around 120°C to provide an opaque heat and flame barrier. The intumescence proceeded quickly and evenly across the glass face, being complete within only a few minutes. Once the initial foaming had taken place, the glass remained unchanged for the remainder of the test. The effect was to totally block out the fire and heat as seen from the outside.

An important consideration in facade situations is radiant heat, which can at relatively low intensity levels (eg 15 to 20kW/m^2) cause ignition of combustible materials, as well as serious burns even for those wearing protective clothing. The measured radiant heat in the large scale facade test on the outer surface of the glazing was *never* more than 1kW/m^2. Furthermore, the temperature of the outside of the glazing took more than 35 minutes to rise above 100°C. Such a high level of performance restricting heat transfer through the facade, in addition to the prevention of external flaming, is of particular importance in protecting firefighters working on the outside, as well as restricting spread of fire.

During the full time of the test, the PILKINGTON Pyrodur™ glass units remained unbroken and the fire was *totally* contained within the room of origin. The vision areas and spandrel panels remained intact, as did the steel framing members. There was no fire breakout through the facade.

Pic: PILKINGTON

A leading company in fire extinguishing systems



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Standards for Special Hazards Suppression Systems

By MITCH LEBOVIC, CAE

The adoption of codes and standards in the fire protection industry, as well as increased public awareness of safety practices, have resulted in substantial reductions in loss of life and property damage due to the effects of fire. When it comes to special hazards systems, two sets of standards are of global significance – those created by the International Standards Organization (ISO) and the National Fire Protection Association (NFPA).

This article will outline both ISO and NFPA standards that apply to clean agent, foam, carbon dioxide and dry and wet chemical suppression systems. For details on the standards, visit the organizations' web sites at www.iso.org and www.nfpa.org.

HALON SYSTEMS

ISO 7201-1 provides specifications for Halon 1301 and Halon 1211 installations. ISO 7201-2 provides a code of practice for safe handling and transfer procedures of Halon 1301 and 1211. In the United States, NFPA 12A is the technical standard that covers designing, installing, testing, inspecting, approving, listing, operating, main-

taining, decommissioning, and removing halogenated agent extinguishing systems.

Because Halon was found to be a potential ozone depleter, there are also guidelines for proper handling and disposal of the agent. Two excellent sources of information are the Halon Alternatives Research Corporation (www.harc.org) and the Halon Users National Consortium (www.hunc.org).

HALON ALTERNATIVES

With the ban on Halon manufacture came the development of environmentally-friendly alternative clean agents. A separate set of standards applies to these agents. From ISO, standard 14520 applies to gaseous fire extinguishing systems. ISO 14520 is comprised of 14 parts. Part one covers general requirements and Parts two through 14 cover agent-specific requirements. The agents are categorized into two distinct classes, halocarbon and inert. Halocarbon agents act largely by heat absorption, although having some chemical effect on the flame combustion reactions. Inert agents contain reactive gases that act primarily by oxygen depletion.

From NFPA, standard 2001 addresses the design, installation, testing, inspection, operation, and maintenance of the new gaseous agent fire suppression systems. It also specifies components for clean agent systems, including agent supply, distribution and detection, actuation and control systems. Information and minimum requirements are included for 11 clean agents.

The most notable difference between ISO 14520 and NFPA 2001 is a change in the safety factor used in calculating the design concentration of extinguishing agents in air. Traditionally, the design concentration was 1.2 times the Cup Burner value but a more rigorous approach has been taken in that the safety factor has been increased to 1.3 times the maximum concentration required to extinguish fires.

Many years' experience has shown that a factor of 1.2 was adequate and NFPA 2001 retains a factor of 1.2 for Class A and C risks. The European Community felt that a higher factor was more appropriate for new installations. However, unless specifically required by the user, existing systems are considered perfectly adequate and do not need to be modified.

Pic: Fire Suppression Systems Association

CARBON DIOXIDE

NFPA 12 provides minimum requirements for installation and maintenance of carbon dioxide extinguishing systems. The standard is prepared for the use and guidance of those who purchase, design, install, test, inspect, approve, list, operate or maintain carbon dioxide fire extinguishing system equipment. It covers total flooding systems, local application systems, hand hose line systems, standpipe systems, and mobile supplies.

FOAM

ISO 7203-1 provides specifications for low expansion foam concentrates

Pic: Fire Suppression Systems Association

Pic: Fire Suppression Systems Association

for top application to water-immiscible liquids. ISO 7203-3 covers specifications for medium and high expansion foam concentrates for top application to water-immiscible liquids.

In the United States, NFPA 11 covers the characteristics of foam-producing materials used for fire protection and the requirements for the design, installation, operation, testing, and maintenance of equipment and systems. Also covered are flammable and combustible liquid hazards and local areas within buildings, and storage tanks and indoor and outdoor processing areas. NFPA 11A outlines the minimum requirements for the installation, design, operation, testing, and maintenance of medium and high expansion foam systems.

DRY AND WET CHEMICAL

ISO 7202 covers powdered fire extinguishing media. In the United States, NFPA 17 provides minimum requirements for dry chemical extinguishing systems, plus discussion of total flooding, local application, hand hose lines, and engineered and pre-engineered extinguishing systems. NFPA 17A applies to the design, installation, operation, testing, and maintenance of wet chemical extinguishing systems. It includes minimum requirements for restaurant and institutional hoods, plenums, ducts, and associated cooking appliances.

APPLICATION STANDARDS

In addition to the installation standards mentioned above, some countries have application standards as well. For example, NFPA 75 is the United States' standard for the protection of electronic computer/data processing equipment.

"If you were putting a clean agent system into a United States computer room, you would look at NFPA 75 for guidance on protecting the room itself," says George Krabbe, chairman of the board of Automatic Fire Controls in South Holland, Ill. and a member of the NFPA 75 committee. "Then, you would look at NFPA 2001 which is the clean agent standard. You would also have to look at the NFPA 72 series for detection standards."

Krabbe adds that an application standard such as NFPA 75 rarely requires a specific type of fire protection. It simply outlines available options and references appropriate installation standards.

Beyond application standards, Krabbe says that local electrical and building codes must be followed. In many cases, those local codes refer back to national standards. But, in cases where they don't, it's always the more stringent code that must be followed.

Pic: Fire Suppression Systems Association

DETECTION STANDARDS

As Krabbe mentioned, anyone installing a special hazards system will also need to be informed of standards relating to fire detection. ISO 7240 is the international standard on fire detection and alarm systems.

NFPA 72, also known as the National Fire Alarm Code, deals with the application, installation, performance, and maintenance of protective signaling systems and their components. This is a comprehensive guide to the design, installation, maintenance, testing, and use of fire alarm system. In the United States, designers, installers, authorities having jurisdiction and maintenance personnel depend on the Code as a source for safety guidelines, up-to-date technology and industry practices.

GLOBAL STANDARDS

There are many standard-making bodies beyond ISO and NFPA. In many cases, the standards adopted by these organizations mirror the ISO standards. In other cases, the standards are unique. Wherever you install a special hazards system, check with both national and local governments to determine applicable codes and standards. Here are a few national organizations that produce fire protection standards.

Europe
Great Britain
British Standards Institute
www.bsi-global.com

France
Association Francaise de Normalization
www.afnor.fr

Germany
VdS Schadenverhutung
www.vds.de

Norway
Det Norske Veritas
www.dnv.com

Australia
Fire Protection Association of Australia
www.fpaa.com.au

SSL Australia
www.sslaustralia.com.au

Asia
China
Tenjuin Fire Institute

Korea
Korean Fire Equipment Inspection Corporation

Hong Kong
HK Fire Services
www.info.gov.hk/hkfsd

Malaysia
BOMBA
www.bomba.gov.my

DUPONT'S NEW STREAMING AGENT, FE-36™ – THE SOLUTION YOU HAVE BEEN LOOKING FOR

DUPONT FE-36™

Halon clean agent fire protection

As the original clean fire-extinguishing agents, Halon 1211 and Halon 1301 were widely used in a variety of applications due to a number of features, which made them extremely valuable to end-users. First, Halons were particularly effective as fire extinguishing agents because they acted directly on the chemical mechanism of the fire. This feature made them effective at relatively low concentrations – they did not need to "smother" the fire, which would require higher concentrations. This both reduced the cost of the hardware and agent needed to protect an enclosure and increased the level of safety for people that could be exposed to discharges of these agents.

Secondly, compared to other extinguishing agents, Halon products were gaseous, highly efficient and electrically non-conductive products, which left no residue. There was no consequential or downtime associated with post-fire clean up. They had low levels of toxicity and were also effective on class A, B and C rated fires making them applicable to numerous applications

Halon 1211, the "old" streaming agent

Halon 1211, also known as BCF, was the primary clean agent used in portable fire extinguishers. This agent is delivered as a stream of droplets aimed at the source of the fire.

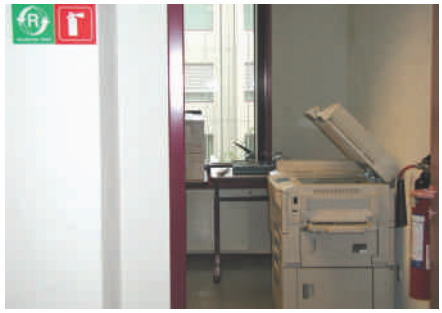
Unfortunately, despite all of the societal benefits of superior fire protection, Halons were found to have a significant, detrimental impact on the earth's ozone layer. The Montreal Protocol, an internationally adopted environmental initiative to phase-out the production of ozone depleting chemicals, mandated a ban on Halon production after 1993.

The ban on Halons left the fire protection industry with the daunting task of developing replacement extinguishing agents. As a leader in the area of industrial safety, DuPont is continuously evaluating new products and new applications for "old" products to improve the level of industrial safety around the world. Consistent with this mission, the DuPont Fire Extinguishants business worked aggressively to develop new, non-ozone depleting, clean fire extinguishing agents designed to replace the "old" extinguishing agents, like Halon 1211.

DuPont™ FE-36™, the "new" streaming agent

From the earliest development work, it was clear that finding a "perfect" replacement for the Halon products was going to be a significant challenge. This was particularly true for Halon 1211, where its cost, toxicity and efficiency made finding a "look-a-like" replacement very difficult. Resulting from this R&D effort, DuPont developed many of the leading clean fire-extinguishing agents used globally today. For example, DuPont developed the technology for the use of HFC-236fa as the leading global replacement for Halon 1211. HFC-236fa (hexafluoropropane) is commonly referred to in the market as DuPont™ FE-36™, a trademark of DuPont.

FE-36™ is the clean streaming agent that comes closest to matching Halon 1211 in its properties and performance, with the added advantage that it is a non-ozone depleting substance. FE-36™ is environmentally acceptable, safe for assets and safe for people. FE-36™ is as close to a perfect replacement for Halon 1211 in portable applications as you can get.



FE-36™ versus CO_2

As a first reaction to the ban and phase out of Halon 1211, many end-users of portable fire extinguishers turned to Carbon Dioxide (CO_2) as an immediate solution to their problems. Unlike FE-36™, CO_2 has no direct effect on the chemical mechanism of the fire. It works by smothering and, to a limited extent, cooling the fire. Because FE-36™ interacts with the chemical reaction that occurs in a fire, it is a more effective fire extinguishant than CO_2.

FE-36™ is rated for class A, B and C fires versus CO_2, which is only rated for class B and C fires. FE-36™ is effective on class A fires because as a streaming agent it can wet the burning material thus reducing the possibility of re-ignition. With FE-36™, the risk of choosing the wrong extinguisher is eliminated. Since CO_2 is not rated for class A fires, which most applications are classified as, a dry chemical unit needs to be located at the fire extinguisher station, which can cause confusion. An example of the cost of using the wrong agent in a fire situation is the fire that destroyed the National Weather Service supercomputer located in Maryland, USA, in September 1999. In order to meet code, a CO_2 and dry chemical extinguisher were located near the supercomputer. When an electrical fire broke out near the supercomputer, the dry chemical fire extinguisher was chosen inadvertently and as a result, the computer was destroyed. The cost of the computer was US$45 million.

FE-36™ is a more effective fire extinguishant than CO_2 requiring less agent and, as a consequence FE-36™ fire extinguishers for a given rating are smaller and substantially lighter than CO_2 ones. This can make them more manageable and easier to use. FE-36™ protects sensitive and valuable assets. It is relatively gentle compared to CO_2 in its application and has no adverse effect on delicate materials such as fabrics, paint, electronic circuits, magnetic storage materials. With FE-36™ there is no thermal shock, unlike CO_2, which discharges from the nozzle at temperatures as low as –50°C.

FE-36™ – Your Solution

A number of companies have already decided that the savings resulting from the use of other agents, such as CO_2 extinguishers, is not worth the risk to protect valuable assets. This is the reason why FE-36' portable extinguishers are selected as the most suitable option to protect high-value assets like computer rooms, telecommunications facilities, process control rooms, museums, etc.

FE-36™ is environmentally acceptable, safe for people and safe for assets. Portable fire extinguishers containing DuPont™ FE-36™ and certified by EN3 and UL are commercially available from several manufacturers. Protect what matters most with DuPont™ FE-36™.

DuPont de Nemours International S.A.
Dupont Fire Extinguishants
1218 Le Grand-Saconnex
Geneva, Switzerland
TEL: +41 22 717 5111
FAX: + 41 22 717 6169
www.dupont.com/fire

Danfoss pumps for water mist systems

LOOKING FOR QUICK FIRE SUPPRESSION WITH MINIMAL WATER DAMAGE? GO FOR HIGH PRESSURE WATER MIST SYSTEMS. DANFOSS PUMPS DELIVER THE WATER PRESSURE.

One of the worlds most advanced microbiological laboratories, Karolinska Institute in Sweden, relies on a high pressure water mist system for fire suppression. And Nessie® pumps from Danfoss deliver the water pressure.

Using high pressure water mist meets some very significant requirements, like being harmless to people and environment, extinguishing fire very quickly with minimum amount of water causing only little or no water damage, and being a lightweight and space saving system.

The areas using water mist systems are rapidly expanding. From the marine and offshore sectors where they have increased safety onboard to segments like tunnels, computer rooms, in machinery spaces and fast response vehicles.

To get the best results using a minimum amount of water, the drop sizes should be smaller than 50 micron, but not larger than 200 micron. To get this and still have a reasonable reach, a high pressure system is the optimum solution.

Danfoss pumps

Nessie® radial high pressure piston pumps from Danfoss are more and more often used because of their low weight, high efficiency and ability to generate uniform pressure without pressure peaks. Furthermore, these pumps are maintenance free in operation.

Combined with the nozzle inserts and the valve programme, a one-stop supplier of components for designing and building water mist systems, Danfoss is a preferred component sub-supplier for high pressure water mist system suppliers around the world. On request we can also deliver custom-made ready-to-use pump units.

Founded in 1933 in Denmark, Danfoss is today a truly global company with sales companies and representatives in more than 100 countries and 20000 employees.

For more information, please contact: Danfoss A/S,
Fax: +45 7445 3831 E-mail: waterhydraulics@danfoss.com.

BEAM DETECTOR PUTS CONTROLS WITHIN EASY REACH

An optical beam smoke detector from Fire Fighting Enterprises allows the user to carry out basic control functions from a convenient location at floor level. FireRay 2000 comprises an infrared transmitter, a receiver and a compact, wall-mounted controller. Unlike detectors with built-in control electronics, the separate controller allows adjustment of sensitivity levels, and checking of alarm and fault status, without the need to climb up to ceiling level or go to the building's main fire control panel.

Two versions of the controller are available. The standard FireRay 2000 unit operates a single beam detector, while for larger installations, the multi-channel FireRay MW version can control up to four devices.

With a single detector able to protect an area of up to 1500 m^2, FireRay 2000 is suitable for installation in most buildings with large interior spaces and high ceilings. Typical applications include commercial premises such as warehouses, factories and malls. In addition, because one device protects an area that would require up to 15 point detectors, the beam detector is ideal for historical buildings where delicate plasterwork makes extensive cabling undesirable.

A drift compensation feature ensures that gradual reduction in signal strength (caused by either a build-up of dust or slight movement of the building) does not result in an unwanted alarm. Also, the detector is able to "ignore" momentary blockage of the beam by insects or birds, while continuous obstruction by an opaque obstacle will cause it to register a fault at the controller.

Suitable for supply voltages between 12 and 24 V DC, FireRay 2000 has a low current consumption, making it easy to integrate into detection and alarm systems. In its quiescent state, the controller draws 8 mA at 24 V DC per channel, while the transmitter draws 5 mA at 24 V DC. The receiver is powered by the controller

For more information, please call:
Fire Fighting Enterprises Limited
Fax +44 (0) 1438 722136 E-mail rbrown@ffeuk.com

Fogtec water mist systems are an efficient and environmentally friendly alternative to Halon, deluge and gas extinguishing systems for the protection of accommodation and machinery areas on offshore platforms.

Particularly gas turbines represent one of the largest risks on offshore platforms, which can ideally be protected with a Fogtec water mist system.

Because there is no other extinguishing agent having the same cooling ability like water, Fogtec systems use high pressure water mist to generate a droplet size distribution giving the optimal combination of a large reaction surface for the heat transfer and the minimum size for sufficient momentum of the droplets.

Numerous tests have proven, that water mist generated by Fogtec systems can reduce the temperature during liquid fuel fires much faster and more efficiently than most conventional systems because of the comparatively poor cooling properties of gas and deluge systems.

The water mist leads to an immediate drop in temperature in case of fire and protects nearby objects and people from radiant heat. Pure water is no danger to people and can be activated immediately after detection of the fire. The smoke scrubbing effect of Fogtec systems, thus binding of smoke particles and washing of water soluble gases, considerably reduces emissions compared to deluge and gas extinguishing systems. Fogtec has successfully undergone approval testing the system for gas turbine protection according to FM standards.

For more information, please contact :
Fogtec Brandschutz Gmbh & Co KG
Fax +49 221 96 223 30 E-Mail: contact@fogtec.com

LPCB APPROVAL FOR LPG ARGON

LPG's ARGON Fixed Fire Fighting Components have been approved by LPCB.

The extinguishing agent used in LPG ARGON systems is Argon, an inert gas that is found in the atmosphere and so it is readily available and easy to refill, unlike blended mixtures. LPG Argon fire extinguishing systems are based on the principle of reducing the oxygen concentration in the protected hazard, suppressing fire by suffocation.

THE NATURAL EXTINGUISHANT

- Naturally occurring gas
- Zero Ozone Depletion Potential
- Zero Global Warming Potential
- Safe for using in occupied areas
- Doesn't leave residues
- No ice formation
- Low refill costs (it isn't blended mixture)

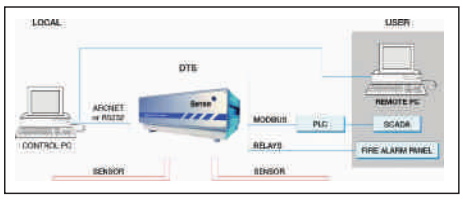
LPG's Argon system has been developed through a continuous R&D programme carried out in its own testing laboratory including combustion chambers. Both the required hardware and software have been develop in accordance with International Standards, holding at present VdS and LPCB approvals.

Since 1985, LPG has been researching, designing, manufacturing and supplying a wide range of fixed fire extinguishing systems to protect life and property. Among LPG's most important products are the total flooding systems based on gaseous extinguishing agents such as FM-200™, FE-13™ LPCB, CNPP and VNIPO approved, CO_2 VdS and VNIPO approved, ARGON LPCB, VdS and VNIPO approved, and also WATER MIST systems. The Company currently has ISO 9001 Quality Certification by the German TÜV and ISO 9002 by LPCB of the United Kingdom.

LPG has also developed a weighing system, which simplifies the process of controlling the extinguishing agent charge in the cylinders. This system is approved by VNIPO.

For more information, please contact:
LPG Técnicas en Extinción de Incendios, S.A.
Fax: +34 93 473 7492 E-mail: export@lpg.es

Sensa



Sensa's Linear Heat Detection System uses fibre optic Distributed Temperature Sensing (DTS) technology. This system is ideally suited for fire detection and environmental monitoring in tunnels and other high risk areas. Sensa's Systems provide real-time temperature data, which can link into the tunnel or building management and control system to maximise safety, optimise tunnel and asset availability and provide condition monitoring for power cables in ducts and tunnels.

These systems offer high integrity, with multiple detection zones and alarm levels over the single length of optical fibre sensor. Hot spots and breaks are detected to within 0.5 m over a single sensor loop, up to 8 km long. Fast polling times provide fast system response to alarm conditions, and continuous temperature profile information permits easy assessment of fire development.

Sensa's range of Linear Heat Detection systems can cover various distances of up to 8 km from one optoelectronics unit. Protective options including stainless steel SensorTube are available. The sensing element contains no electronic components and is therefore ideal for harsh environments, and is economical to maintain.

The system can output to relays, Modbus and PC visualisation concurrently. Tunnel operators, power utilities, constructors and engineers can benefit from Sensa's Linear Heat Detection Systems.

For more information, please contact: Sensa,
Fax: +44(0)2380 275305 E-mail: info@sensa.org

SUPERINTENSIVE FOAM FLOODING

A revolution in tank fire extinguishment

Foam is the most suitable agent to extinguish fires in a storage tank containing flammable liquids. Foam application rates are traditionally NFPA-11 based and are typically 4.1 l/min/m^2 for fixed systems, 6.5 l/min/m^2 for monitor application, and 12.2 l/min/m^2 for rim seal areas.

It is known that doubling or tripling the standard foam application rate results in a very high success rate of extinguishment.

Using conventional methods to achieve such a high application rate requires a lot of foam generators, many foam pourers, high water pumping rate and very high foam proportioning capacity. This means there are cost implications that prohibit the selection of such a system.

Superintensive Foam Flooding

- IFEX Engineering Co. in Hungary developed a revolutionary new extinguishing concept, using 5-10 times higher foam solution intensity, than the traditional recommendations prescribe. That is the Superintensive Foam Flooding (SFF).
- It uses extremely high foam flow rates, which is provided by the new foam application device, called Continuous Linear Nozzle (CLN).
- The feeding of the CLN requires a high performance foam supply system. The most suitable foam supply system is the Self Expanding Foam system (SEF). There are two alternatives: the fixed SEF foam supply system or the mobile SEF foam supply system.
- One of the advantages of the Self Expanding Foam concept is, that it has no release rate limitations. By combining the SEF method with the newly developed high capacity CLN, it is easy to achive the application rates of 20-30 l/min/m^2.
- The result of this combination is a highly efficient system. Tests carried out on a 500m^2 gasoline tank on fire repeatedly resulted in extinguishment in less than 30 seconds. The reliability of the system is very high, the valve is the only moving part.
- The SEF storage vessel can be fixed, located near to the hydrocarbon tank, or mobile and carried by a truck.

Advantages of the SEF system over conventional systems

- Requires considerably lower capital investment.
- Requires considerable lower operating costs.
- The system is fully autonomous and does not require water system backup.
- It does not require external energy sources like fire truck or electric pump.
- Is so simple that making mistakes under stressful fire conditions is unlikely.
- Its simplicity eliminates the need for specialists to operate and maintain the system.
- Uses a perfectly proportioned foam, mixed under calm and controlled conditions.
- The foam is stored under pressure; no pump or other pressure raising source is required.
- The pressure of the container determines the expansion; no aspirating device is required.
- Produces optimum quality foam at all flow rates.
- Its flow rate is virtually unlimited; pumps, proportioners and aspirating devices are not there.
- Very high foam producing rates can be easily achieved at modest cost.
- Has only a few key elements requiring regular inspection.

For more information, please contact:
T F E X Engineering Co.
Fax: + 361 249 2114 E-mail: szocs@ifex.hu

DEVELOPMENTS IN ELECTRONIC DATA PROCESSING PROTECTION

Protection of High Value Assets and Data is vital to modern day companies, many companies have moved from manpower to machine power relying heavily on the technology to assist in their day-to-day operations.

Normal protection of this equipment would entail a complicated system design along with a considerable cost to the user for the installation of such a system; large applications also involve considerable system downtime and clean up operations in the event of a false activation or real fire activation affecting only one part of the area.

With this in mind redetec™ was developed by **Tailored Fire Products** to provide a cost effective solution to protection of this essential equipment.

redetec™ is a compact unit for use in 19" equipment racks; the unit is generally located at the top of the cabinet which affords greater protection of the equipment situated below. Within the redetec™ unit is a choice of detection, an array of control features and a choice of extinguishing agent – all situated within the aesthetically pleasing 2U (88mm) high control panel.

Advantages

One of the major advantages of redetec™ is its simplicity, once the type of unit has been decided it is simply matter of plugging it into the mains supply and the cabinet is protected. Of course the redetec™ comes complete with 24hr battery back up as standard and is packed with many more features.

The unit has an array of remote outputs and inputs for communication to other monitoring equipment.

The amount of extinguishing agent required to suppress a fire within a cabinet is minimal which allows the agent to be mounted within the control panel, this of course comes as standard.

Applications

There are many applications for redetec™ which range from a single office with a small server to a large EDP room with hundreds of cabinets.

Types of Extinguishing Agent

At the moment redetec™ can utilise both Pyrogen® and FM200®

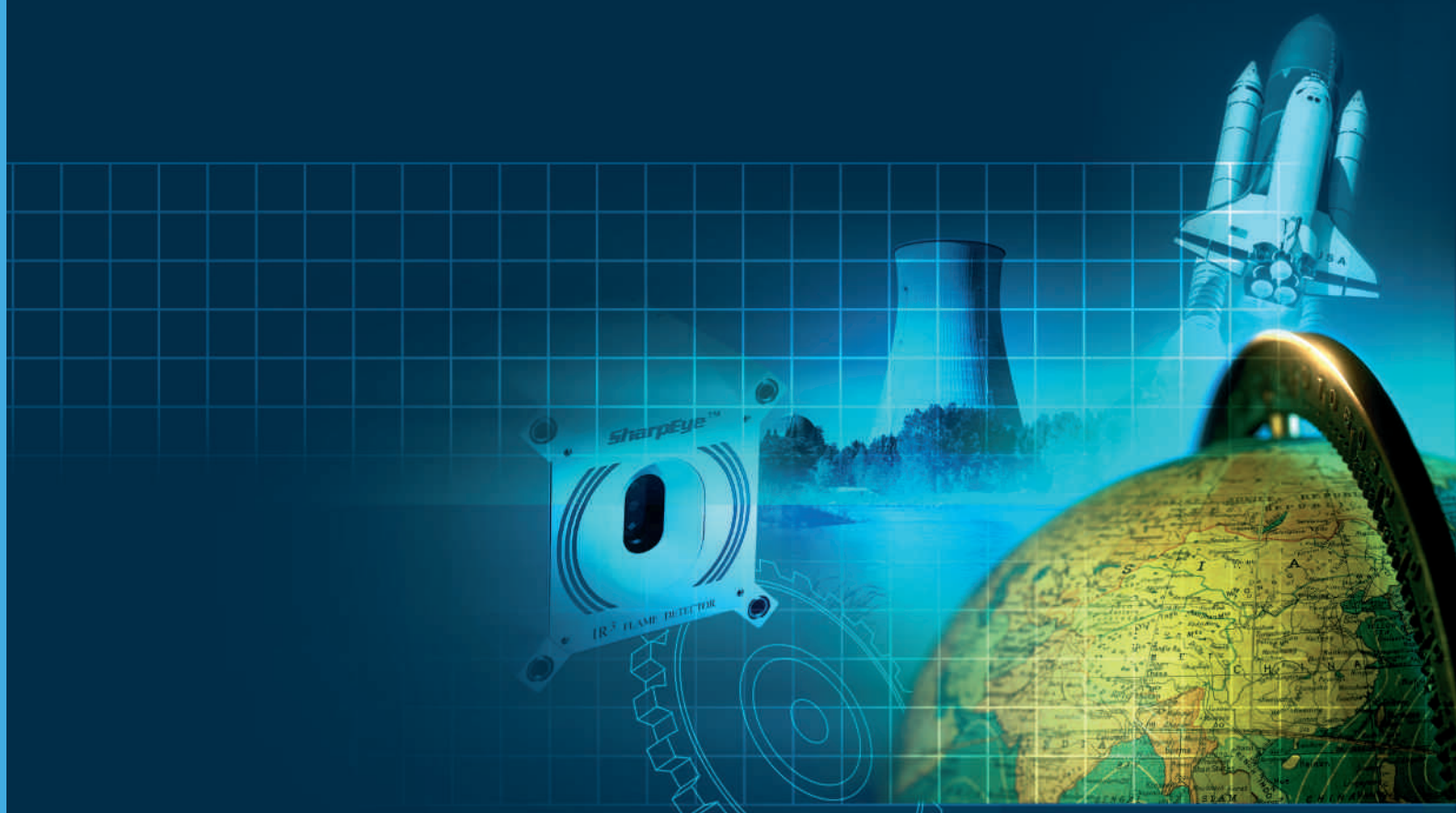
redetec™ is a trademark of tailored fire products
FM200®™ is a registered trademark of Great Lakes Chemical Corporation
Pyrogen®™ is a registered trademark of Pyrogen Ltd

For more information, please contact Tailored Fire Products
Fax: +44 (0)1204 380 474 E-mail: info@redetec.co.uk

2ND INTERNATIONAL WATER MIST CONFERENCE IN AMSTERDAM

After the first successful annual conference in April this year in Vienna, Austria, the venue and date for the 2002 symposium have been determined recently. This event to be organized by the IWMA is, hence, the 2nd International Water Mist Conference. The conference is scheduled for April 10-12 and will be held in cooperation with independent institutions who are members of the IWMA. They are going to provide the necessary scientific support for the symposium. The Parkhotel in Amsterdam, The Netherlands, was chosen as next year's location.

For more information, please contact IWMA
Fax: +49 39 202 85 250 E-mail: icke@iwma.net



FLAME & GAS DETECTION

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Performance & Quality

SPECTREX INC.

SharpEye™ Flame DETECTORS

SHARPEYE UNMATCHED PERFORMANCE AND QUALITY

The **SharpEye** Flame Detectors incorporate advanced optical spectral analysis of flames and are contained in rugged, explosion-proof aluminum or stainless steel housings. **SharpEye** Flame Detectors operate reliably in the harsh conditions of offshore drilling and production platforms, FPSO vessels, fuel loading facilities, LNG and LPG plants, oil refineries, aircraft hangars, paint spray booths, gas turbine power stations, chemical and petrochemical plants.

The **SharpEye** Flame Detectors are approved by internationally accepted Standards Institutes such as FM (Factory Mutual), CENELEC (Europe), CSA (Canada), SAA (Australia). These detectors employ the latest UV (Ultra Violet), IR (Infrared), UV/IR (Ultra Violet & Infrared), IR^3 (Triple IR multi-spectrum detection) and the new unique CCTV flame detection technologies.

SharpEye offers an unmatched performance and reliability range of products including the world's fastest UV/IR flame detector (under 2 milliseconds) with the greatest immunity to false alarms, as well as the world's leading Triple IR (IR^3) patented technology that enables the detection of small fires at long distances while providing enhanced immunity to false alarms.

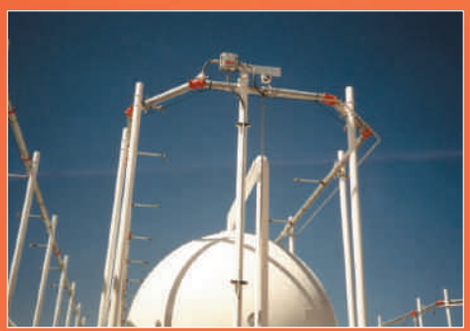
SHARPEYE RANGE OF FLAME DETECTORS

- IR Optical Flame Detectors
- UV Optical Flame Detectors
- UV/IR Optical Flame Detectors
- Ultra Fast UV/IR Optical Flame Detectors
- Military UV/IR Optical Flame Detectors
- IR^3 Optical Flame Detectors
- Fast IR^3 Optical Flame Detectors
- CCTV Flame Detector

TYPICAL FLAME DETECTION APPLICATIONS

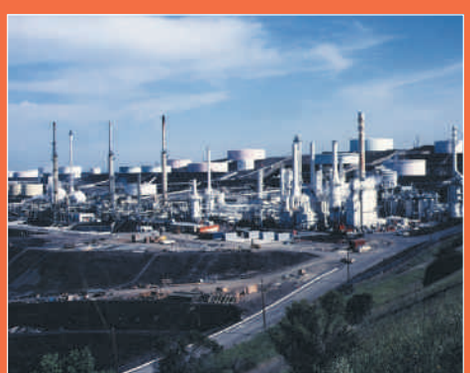
- Oil and gas production, processing, transportation and storage areas
- Fuel loading terminals
- Aircraft hangars
- Nuclear power stations
- Chemical production, processing, transportation and storage areas
- Warehouses and storage facilities
- Waste disposal facilities
- Ammunition work stations
- Polymers, paper, timber, semiconductor industries
- Ammonia and urea industries
- Various unmanned indoor and outdoor high-risk areas

Oil and Gas
APPLICATIONS



Propane storage facilities protected by **SafEye** Open Path Gas Detection Systems

SafEye Optical Open Path (Line-of-Sight) Gas Detectors are installed on numerous FPSO vessels and offshore platforms in the UK and Norwegian sectors of the North Sea



SharpEye Flame Detectors and **SafEye** Open Path Gas Detector Perimeter (fence line) Monitoring Systems protect a typical petrochemical plant

SharpEye Triple IR (IR^3) advanced flame detectors are installed in industrial indoor and outdoor applications such as aircraft hangars, petrochemical plants, automotive industries and power generation facilities

The entire range of **SharpEye** explosion-proof flame detectors covers offshore installations

SafEye™ Gas Detection SYSTEMS

SAFEYE OPTICAL OPEN PATH GAS MONITORING SYSTEMS

The **SafEye** range of "line-of-sight" optical gas detectors features a new generation of Open Path IR and UV detection. Open path spectroscopy offers unprecedented reliability in real-time monitoring of gaseous emissions over large areas, rendering it the accepted technology for industrial and environmental applications. The systems provide exceptional detection capability of gas/vapor concentrations ranging from as low as Parts Per Million (PPM) levels to Lower Explosive Limit (LEL) levels in a wide range of hazardous conditions and ambient air monitoring.

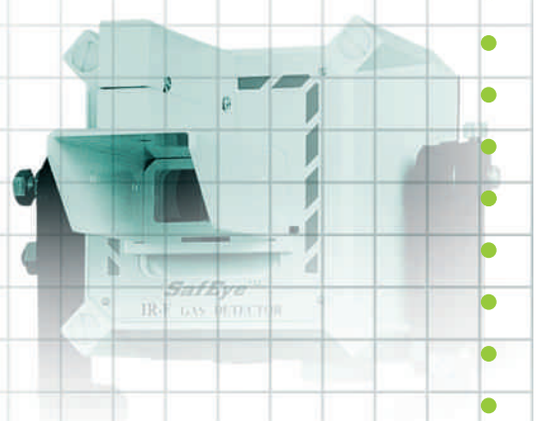
The **SafEye** system employs a unique flash light source coupled with optical detectors and mathematical algorithms to spectrally analyze an air path ranging from 2 ft. to 450 ft. (0.6m - 140m) with high detection sensitivity in both UV and IR spectral bands. The system is compatible with a wide range of control systems providing multiple outputs (dry contacts, 4-20 mA, RS-485).

The open path line-of-sight gas detection system can monitor and transmit an alarm signal prior to occurrence of fire or an explosion, identify the chemical family concerned and activate preventative systems.

The **SafEye** gas detection system can serve as a process control component in the chemical and petrochemical industries, or as a safety system in commercial and industrial applications.

TYPICAL GAS DETECTION APPLICATIONS

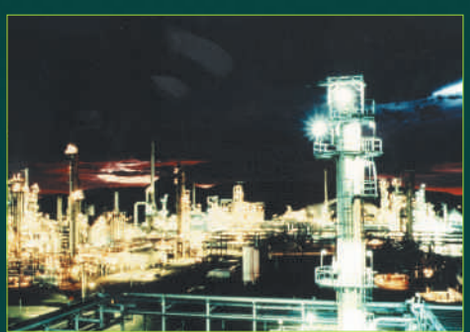
- Oil and gas industry - offshore and onshore platforms, refineries, storage facilities and pipelines
- Petrochemical, pharmaceutical, chemical process, storage and production areas
- Waste treatment and disposal sites
- Hazardous materials loading docks, transportation and shipping depots and warehouses
- Compressors, turbines and pumping stations
- Paint spray booths in automotive manufacturing
- Fuel and gas storage loading and distribution terminals, LNG - LPG systems and natural gas bus garages
- Process control applications including:
  - Gas monitoring in chemical processes
  - Desulfurization process (H_2S)
  - Monitoring toxic and flammable gases in air-ducts and air-intakes



Industrial APPLICATIONS

SharpEye Triple IR (IR^3) Flame Detectors and **SafEye** Open Path Gas Detectors protect El Paso, Texas Gas Storage Tank Farms

SharpEye Triple IR (IR^3) Flame Detectors and **SafEye** Open Path Gas Detectors protect Brevik Chemical Waste Treatment Plant in Norway



SharpEye and **SafEye** Detectors work in difficult environmental conditions and incorporate sophisticated algorithms and logic to prevent false alarms, providing fast and accurate detection over great distances

SafEye Duct Gas Detectors protect BP installations in Prudhoe Bay, Alaska, where temperatures can reach -40˚F (-40˚C)

135 **SharpEye** Triple IR (IR^3) Flame Detectors and 110 **SafEye** Open Path Gas Detection Systems protect ETAP (Eastern Trough Area Project), North Sea, UK, one of the world's largest and most modern offshore oil production platforms

Military Vehicle **SYSTEMS**

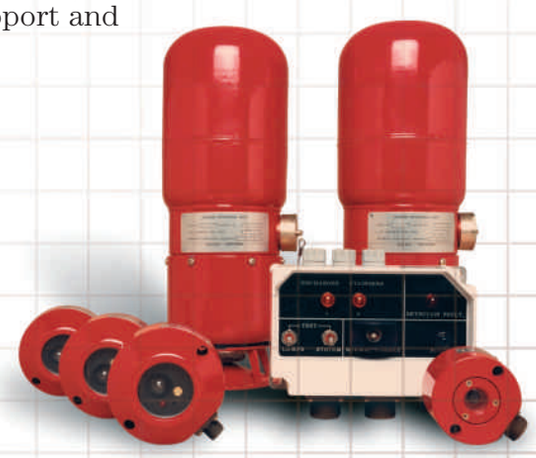
The Military **S.A.F.E.** Vehicle Automatic Fire and Explosion Detection and Suppression System was developed to address the United States' and other leading armies' requirements for crew survivability and safety, vehicle survivability as well as system survivability in all operating conditions. The systems are designed to meet strict military standards and specifications.

Internationally, more than 50 types of armored vehicles including Main Battle Tanks (Leopard C1, M48, M60, T62, T72, AMX 30, Kurrassier), Armored Personnel Carriers (M113, BMR, VEC), Armored Fighting Vehicles (Pizarro, Leonidas), Artillery vehicles (M109, M110, FAASV, CPV) and special purpose vehicles (Engineering, Recovery, Bridge Launching) have been integrated with over 9,000 **S.A.F.E.** systems to date. These systems were thoroughly tested, were approved by several NATO and other leading armies. These systems are well proven and have an excellent track record of performance and reliability.

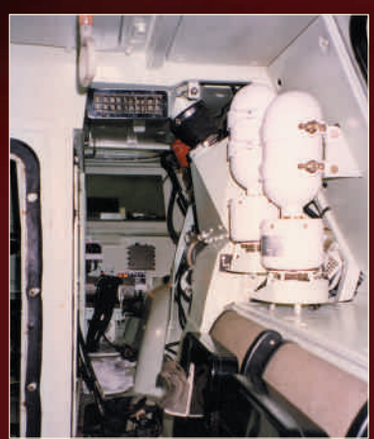
Use of the **S.A.F.E.** system results in a substantial increase in crew and vehicle survival, reduced vehicle loss, increased capability and improved morale among the troops.

The system protects against combat-initiated and slow-growth fires featuring high-speed optical detection in less than 3 milliseconds, explosion suppression within 150 milliseconds, multiple ultra fast extinguishing agent discharge and dispersion. Control electronics provide system activation logic, self and built-in test capabilities, system monitoring and communication with vehicle electronics. System components are robust, comply with the latest Mil-Specs and provide for a highly reliable free of false alarm system.

Spectrex has accumulated worldwide experience in armored vehicle projects involving all stages from assistance in prototype integration through supervision of serial production and installation, and provision of documentation, Integrated Logistic Support and after sales services.



Military Systems
APPLICATIONS



Crew Compartment System incorporates environmentally acceptable extinguishing agents

S.A.F.E. Systems incorporate optical flame detectors, control electronics, rapid discharge cylinders and field test equipment

Integrated damage control system incorporates sensing of fire, heat, smoke, flooding and status indications from auxiliary systems

Engine Compartment System employs state-of-the-art discharge and dispersion technologies

Military Systems protect both crew and engine compartments of wheeled and tracked armored personnel carriers and fighting vehicles

Flame & Gas Detection of

unmatched

Performance & Quality

Spectrex Inc.
218 Little Falls Road
Cedar Grove, NJ 07009 USA
Tel: 1 (973) 239-8398
Fax: 1 (973) 239 7614
E-mail: spectrex@spectrex-inc.com
Web-site: www.spectrex-inc.com

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Fire & Safety Taipei 2002

International Exhibition of Fire, Safety & Disaster Management, Taipei

Time : **March 13 ~ 15, 2002**
Venue : **Hall 1, Taipei World Trade Centre**
(No. 5, Sec. 5, Hsin Yi Road, Taipei, Taiwan)

- **Concept Oriented Pavilions**
  - Systematic Educational Tour for Enterprise Users
  - Case Study Showcase Provides Vivid Know-how
- **Fire & Safety Forum**
- **Taiwan Fire & Safety Excellent Construction Award and Ceremony**
- **Fire & Safety Buyer's Gala**

Supported by Government and Official Association:

- Ministry of the Interior, Taiwan
- National Fire Administration, Ministry of the Interior, Taiwan
- Taiwan Fire Fighting Industry Association
- Taipei Fire Fighting Engineering Equipment Commercial Association

For speaking or participating opportunities, and costs, please contact the organizer directly or visit our website: **www.secutech.com** for further information.

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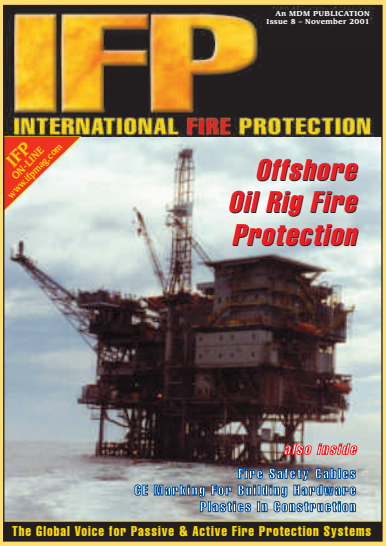

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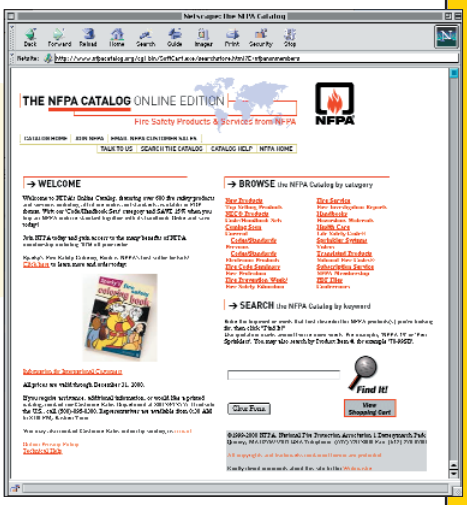

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